Strategies to Reduce CMV Crashes in Michigan

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UNIVERSITY OF MICHIGAN
TRANSPORTATION RESEARCH INSTITUTE

Outline

- Introduction
- Scope of CMV Crashes and Cash Costs
- Crash Circumstances
- Crash Types and Hazardous Actions
- Driver Age and Driver Fatigue
- Driver Histories
- Vehicle Condition, Carrier Type, Carrier Size
- Geographic Location of Crashes, Costs, Inspections
- Summary of Results
- Countermeasures and Strategies

Purpose: Provide analysis to support Michigan Truck Safety Commission's strategic plan to improve truck safety in Michigan

- Identify key issues in CMV crashes
- Propose innovative solutions

- Initiated October 2006
- Presentation to MTSC July 2007
- Driver history analysis April 2008

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MTSC Strategic Plan

- Reduce Fatigue-related crashes
- Strengthen CDL program
- Advance Share-the-Road
- Improve truck maintenance
- Identify/correct unsafe infrastructure & operations
- Improve CMV safety data
- Promote industry safety initiatives

Top-level Targets

- CMV Driver conditions/contribution
- CMV Vehicle factors
- Other vehicles/drivers in the crash
- Operational factors
- Safety data available

Approach

- Top level problem identification and prioritization
  - By size (frequency)
  - By index of “harm”
- Detailed analysis target crash types/conditions/factors
- Identify crash countermeasures (literature review, etc.)

Sources of Data

- **Michigan Police-Reported Data (UD-10), 2001-2005**
- **Driver History files**
- **MCMIS Census and Inspection files**
- **Michigan FACT data (1996-2001)**
- **UMTRI's TIFA file (1999-2004)**

Scope of CMV Crashes and Crash Costs

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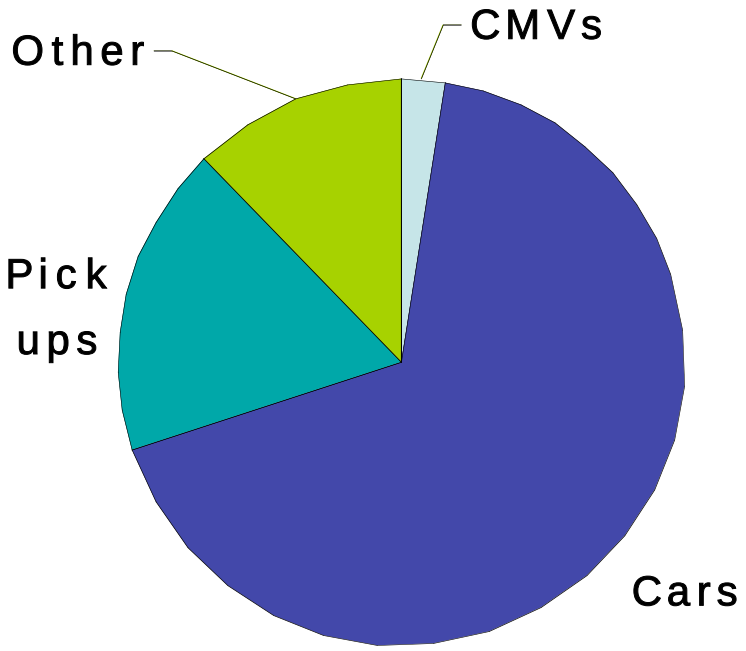
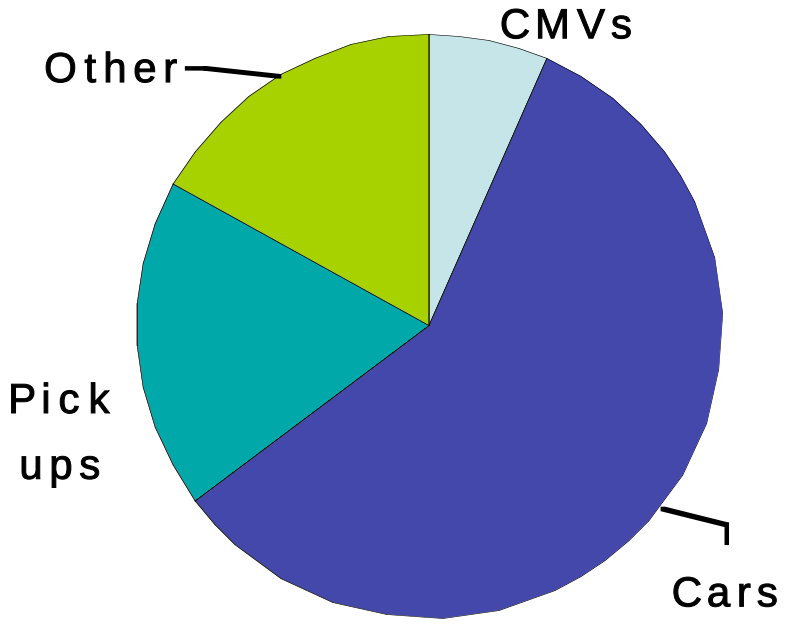
Average Annual CMV Crash Involvements

Fatal	128
A-injury	425
B-injury	805
C-injury	1,936
Property Damage Only	14,028
Total	17,323

CMVs in All Crashes and Fatals

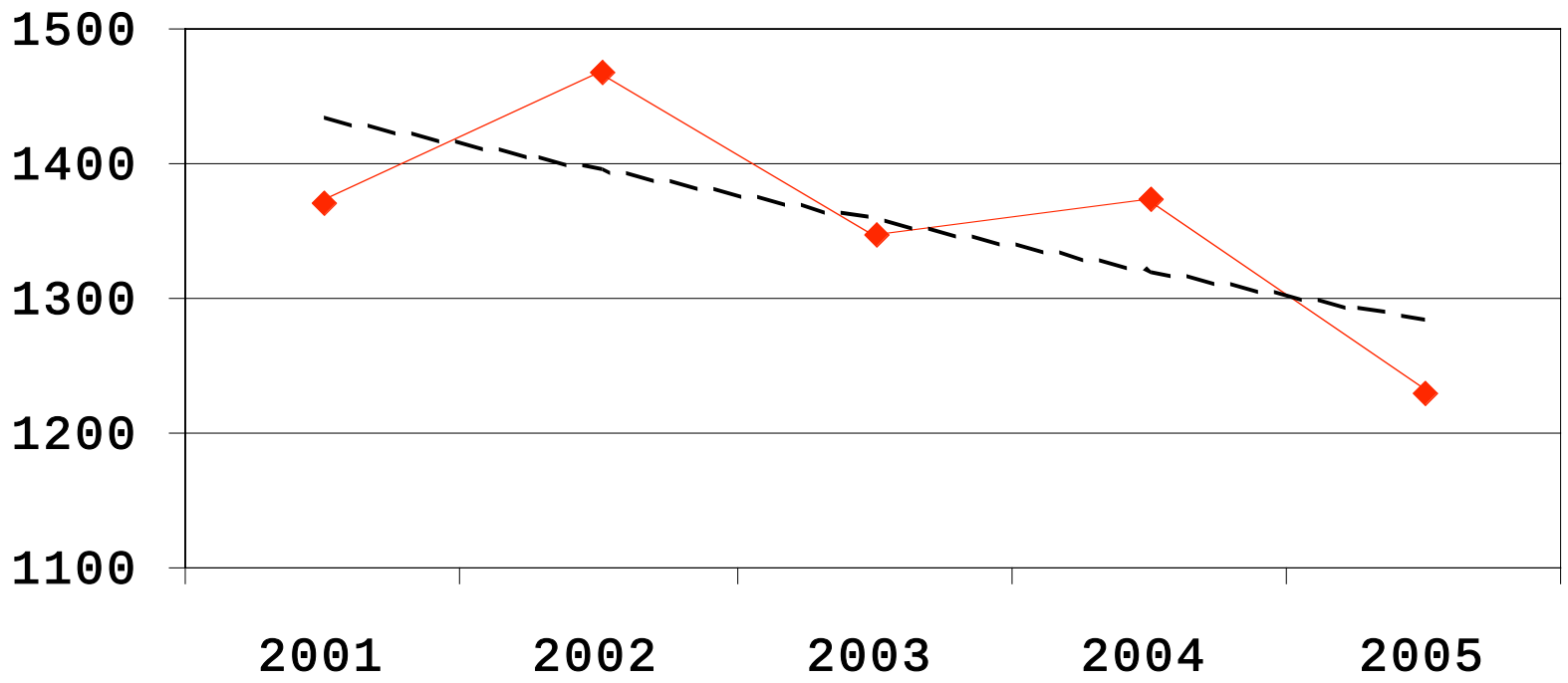


All Crashes



Fatal Crashes

Annual Fatal & Serious Injury CMV Involvements



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"Harm" Measured by Crash Costs

Developed by Zaloshnja & Miller for FMCSA (2002)

- **Medical costs**
- **Emergency Services**
- **Property Damage**
- **Lost productivity**
- **Reduction in Quality of Life**

Fatal	**$2,671,000**
A-injury	**98,800**
B-injury	**36,900**
C-injury	**31,900**
PDO	

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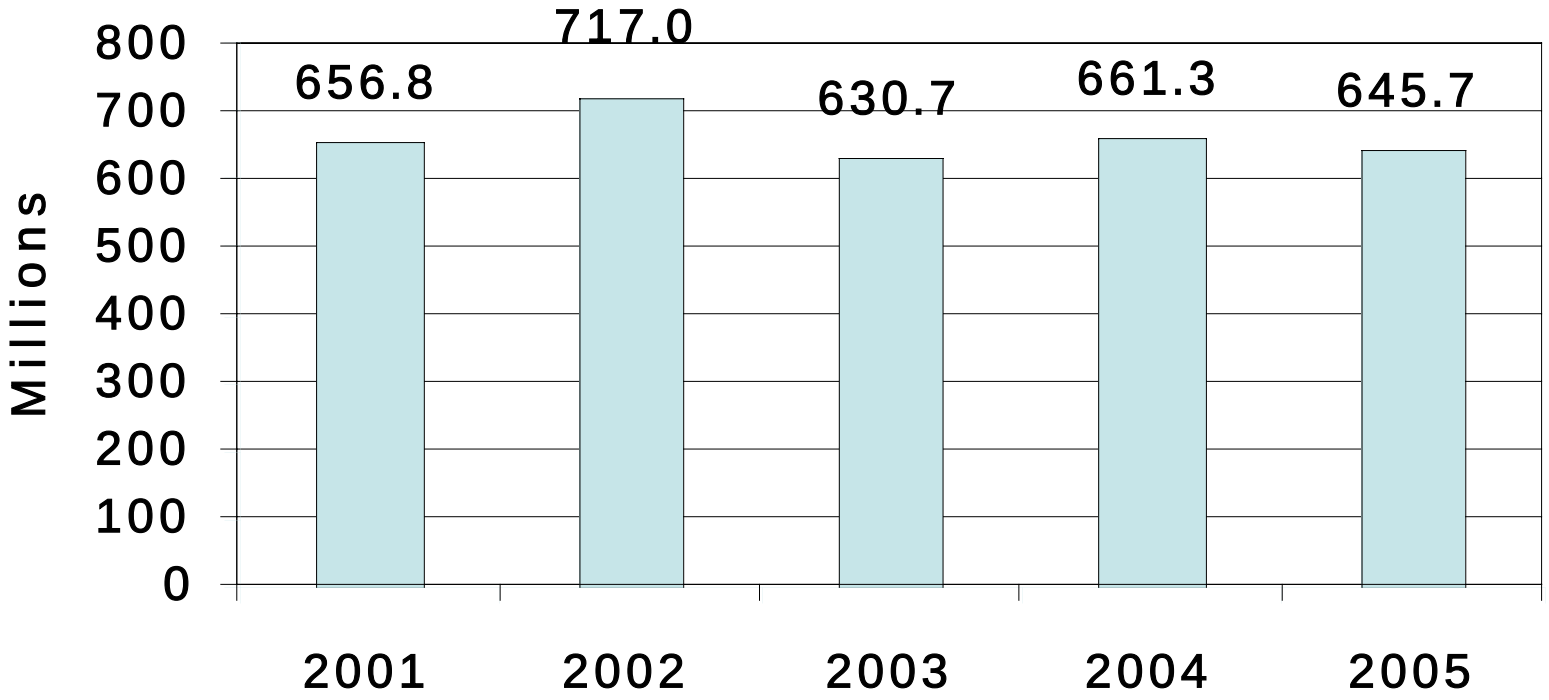
Annual Cost of CMV Crashes
(millions)



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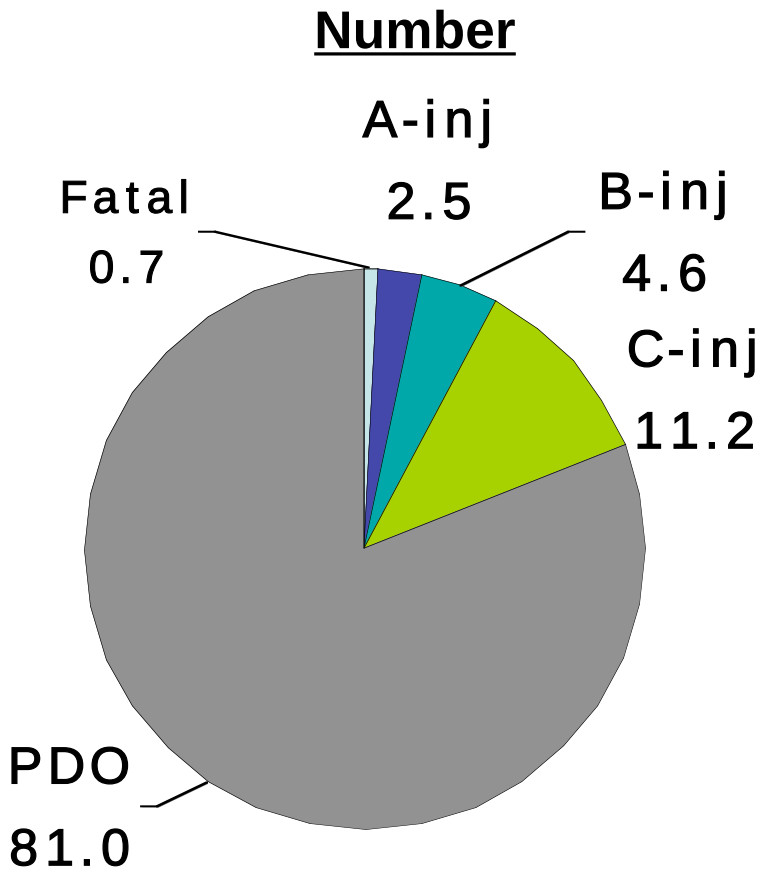
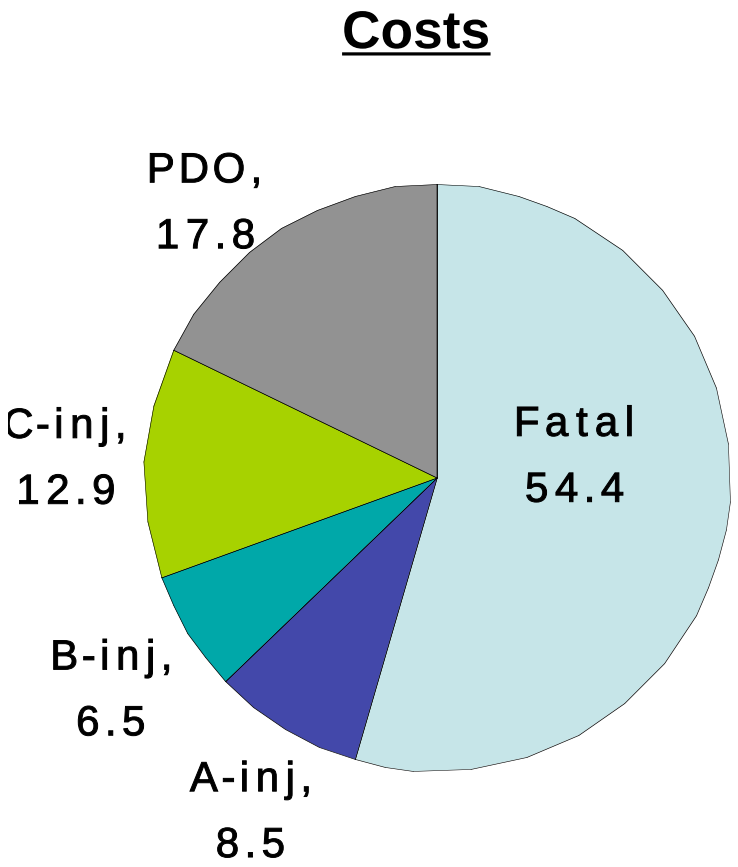
Proportion by Frequency and Cost





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Crash Circumstances: Time of Day and Road Type

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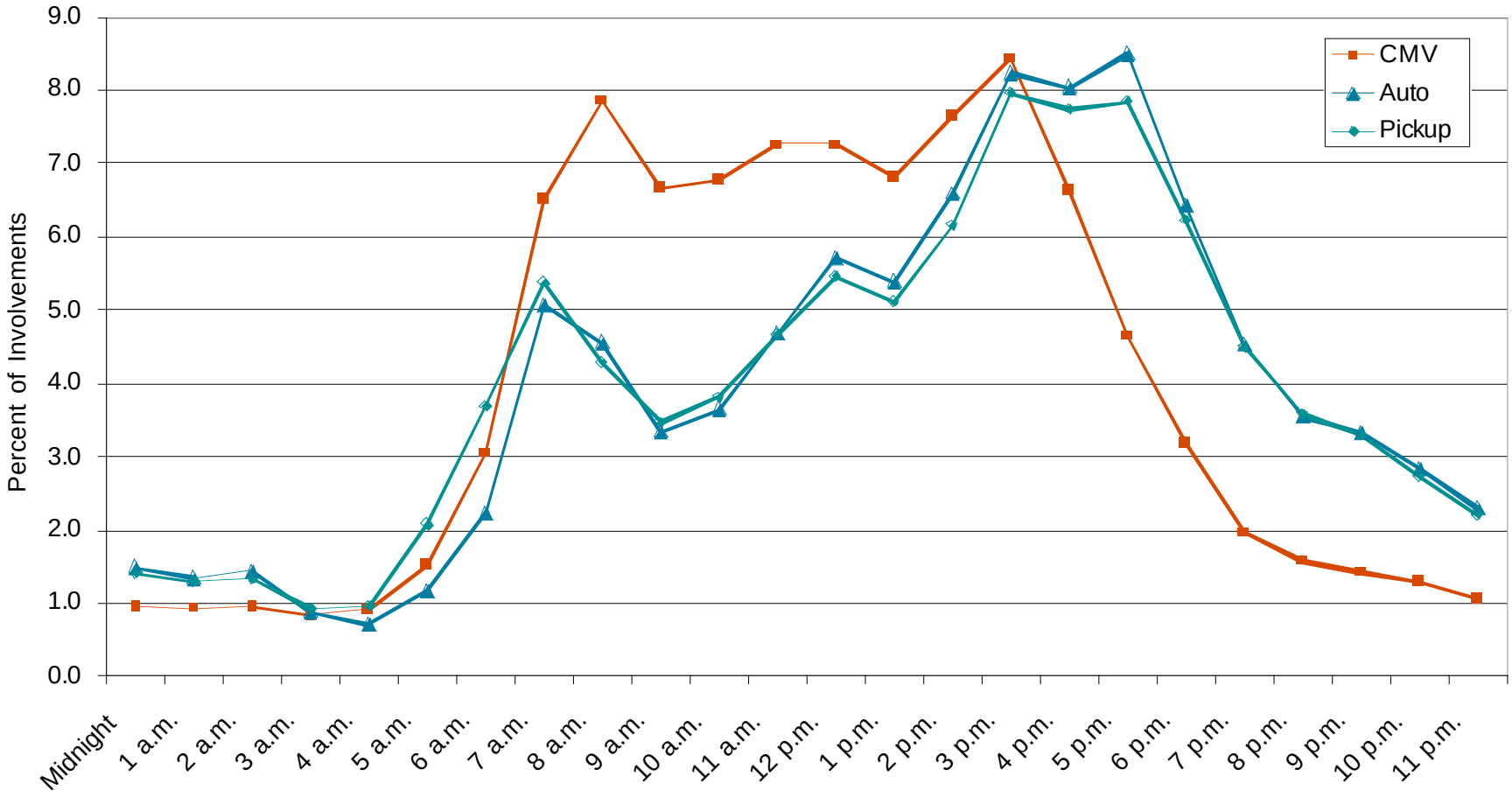
Crash Involvements by Time of Day



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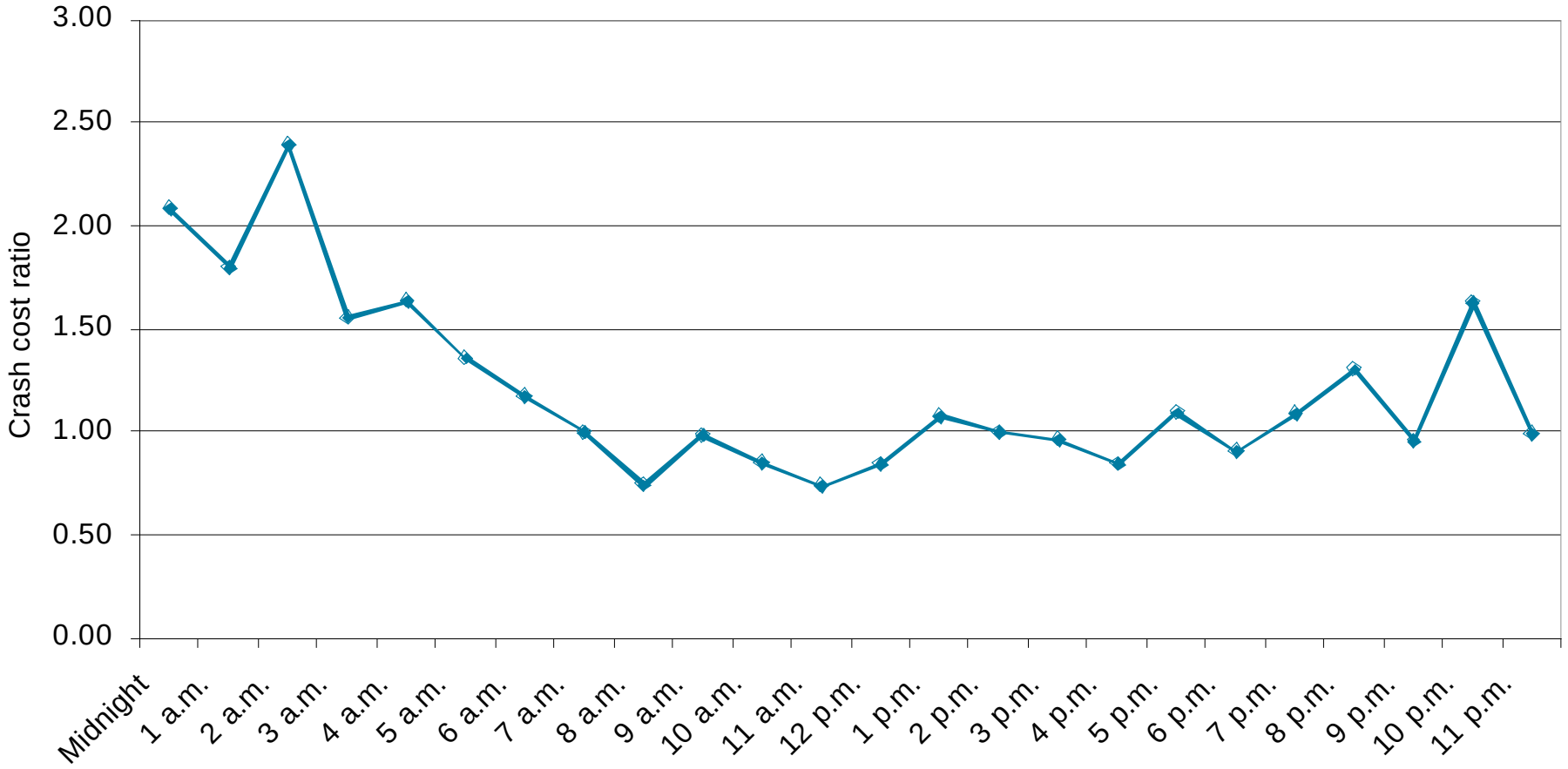
CMV Ratio of Crash Costs to Involvements by Time of Day



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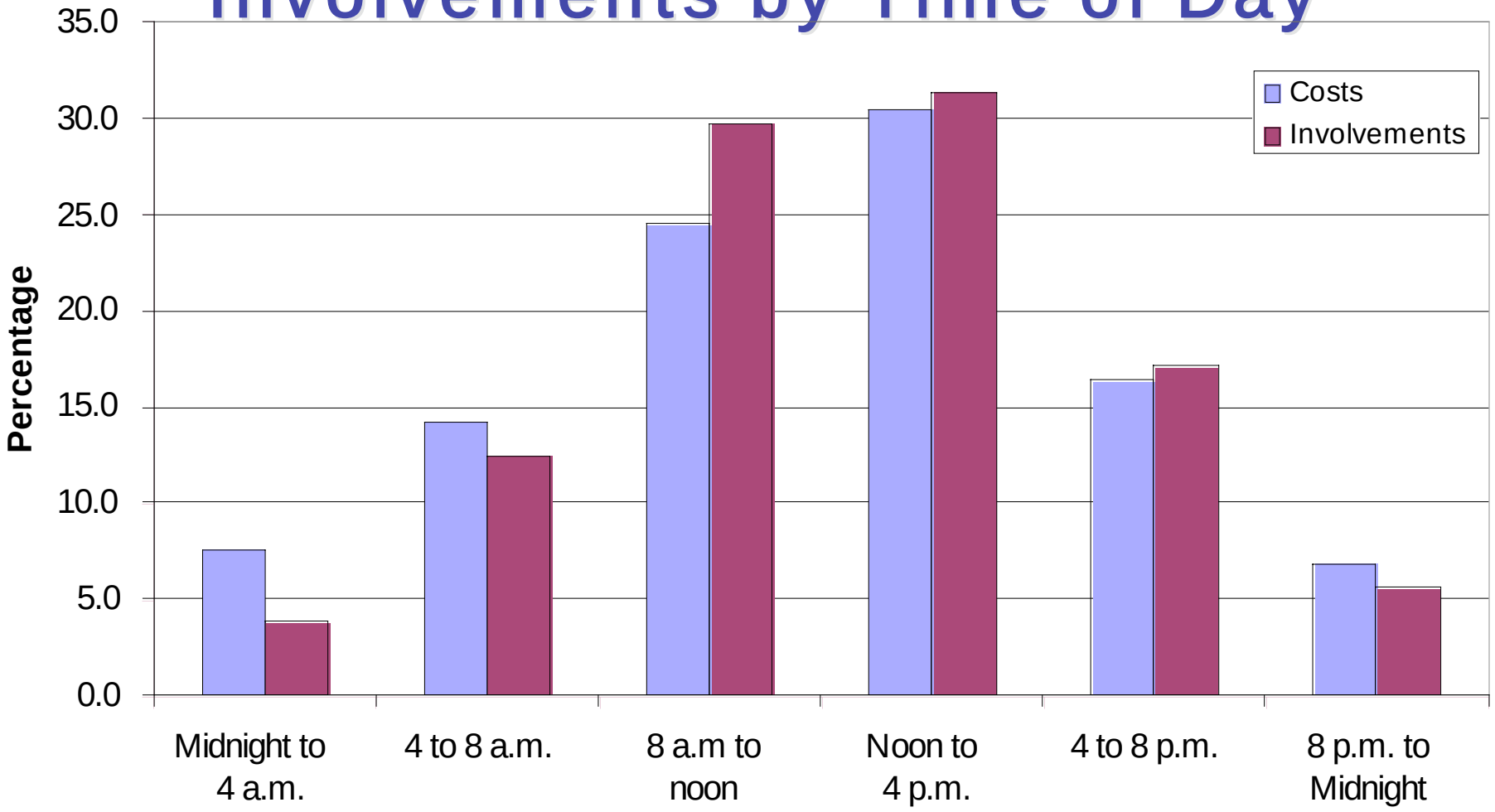
Distribution of Costs & Involvements by Time of Day



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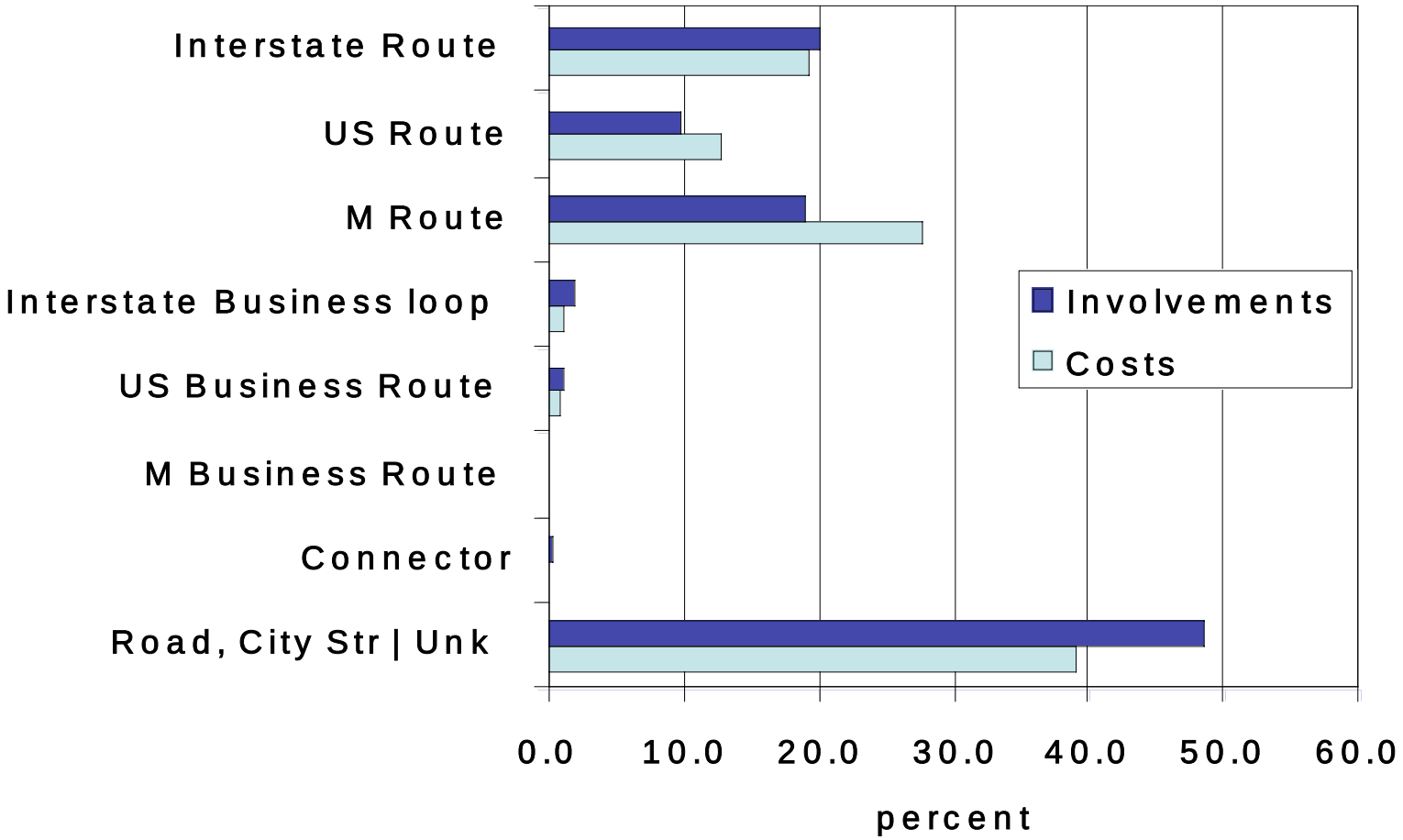
CMV Crash Costs & Involvements by Route Type



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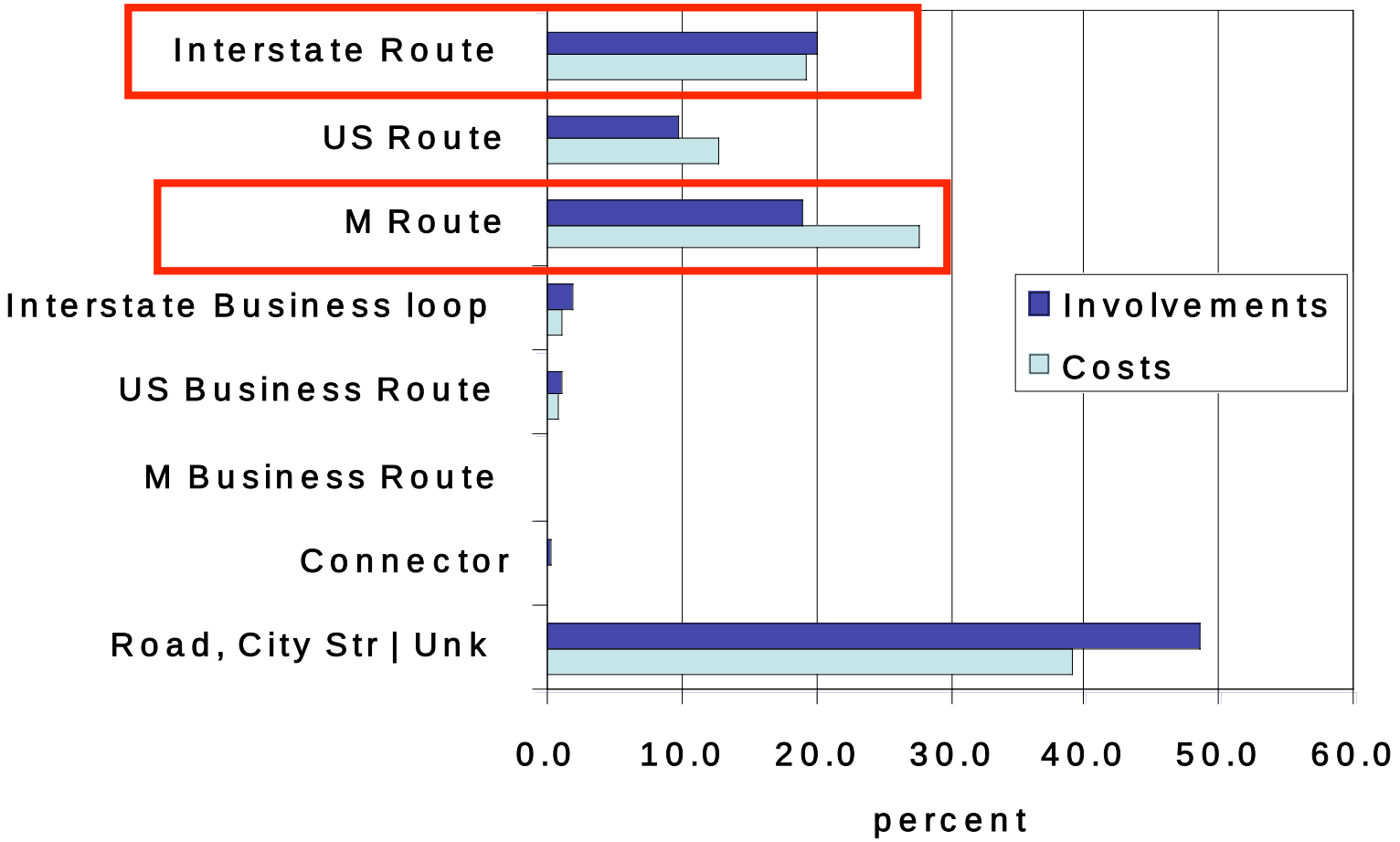
CMV Crash Costs & Involvements by Route Type



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Crash Types and Hazardous Actions

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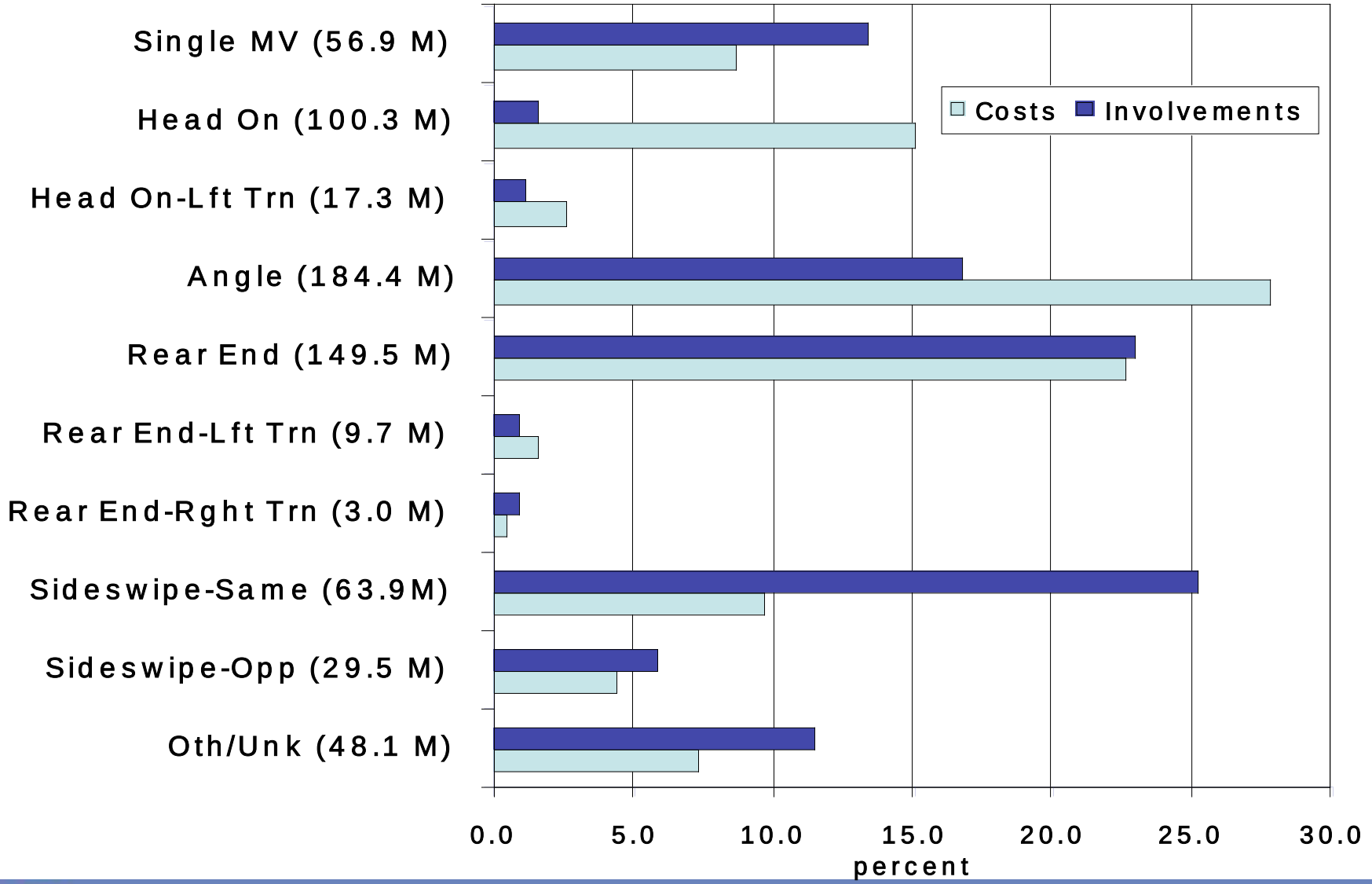
CMV Crash Types, Costs & Involvements



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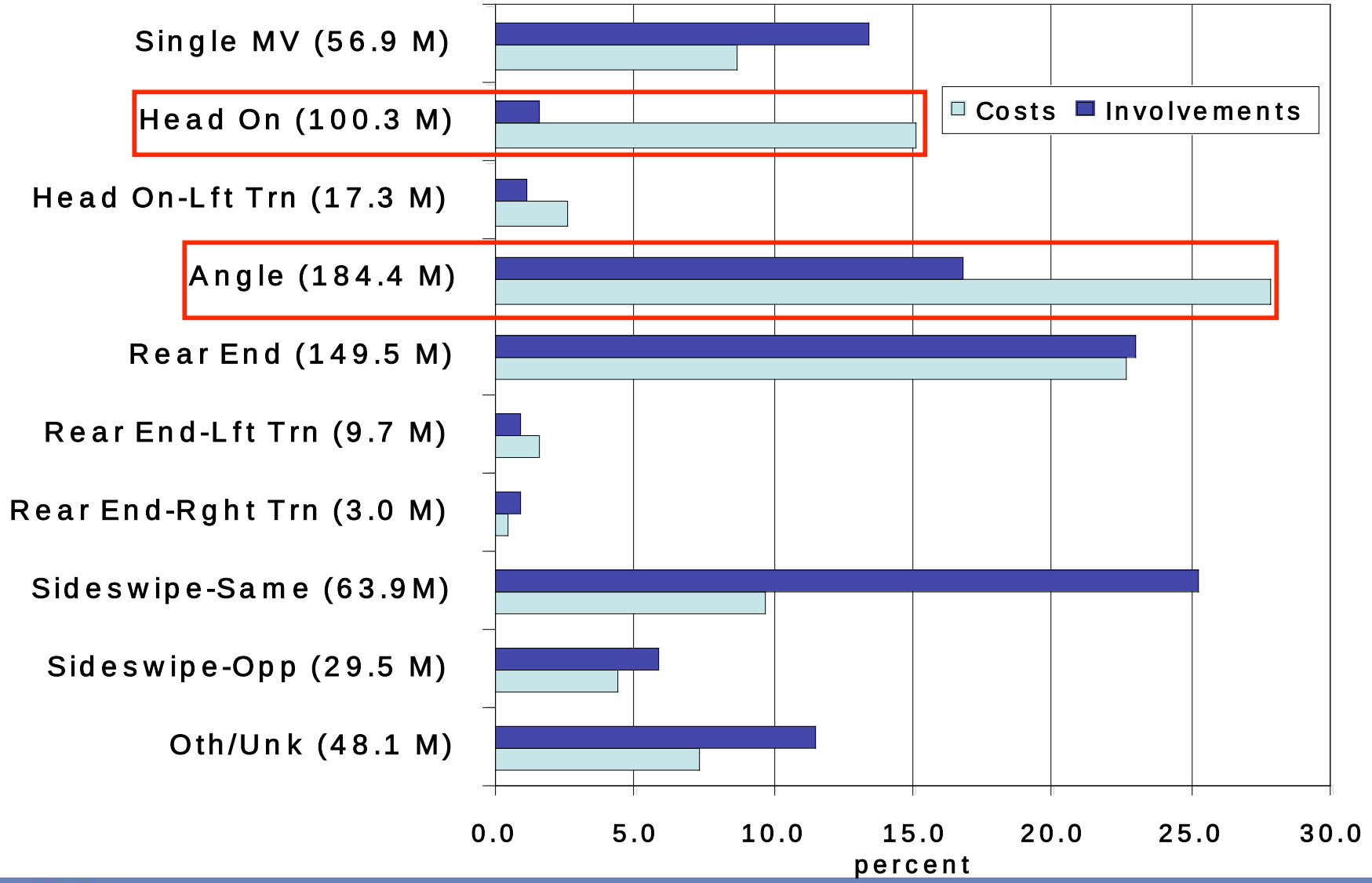
CMV Crash Types, Costs & Involvements



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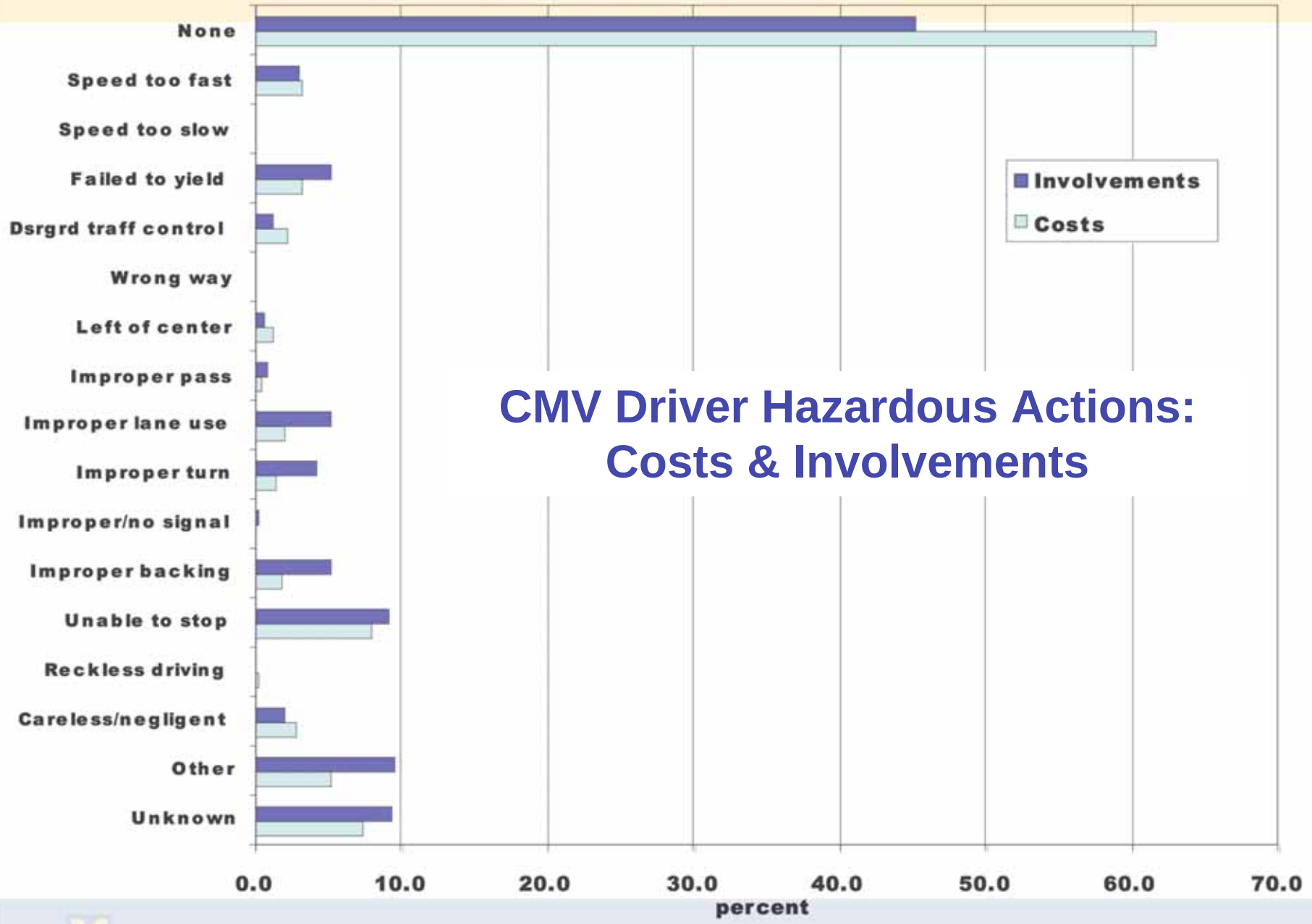
CMV Driver Hazardous Actions: Costs & Involvements



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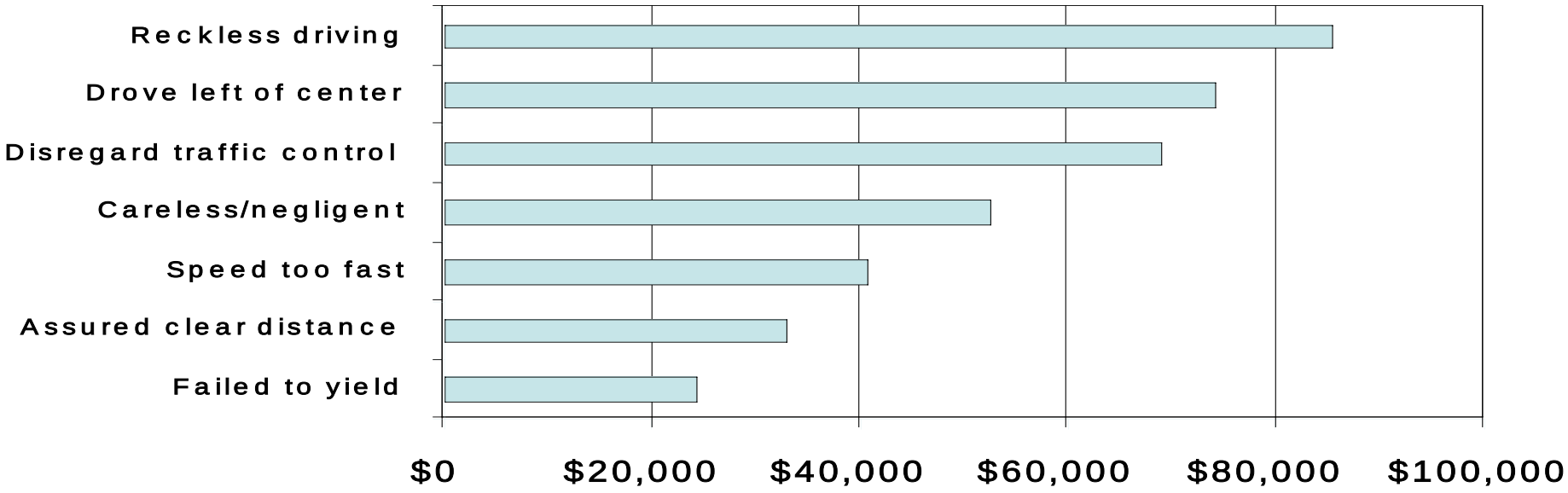
Top CMV Hazardous Actions, Ranked by Costs Per Crash



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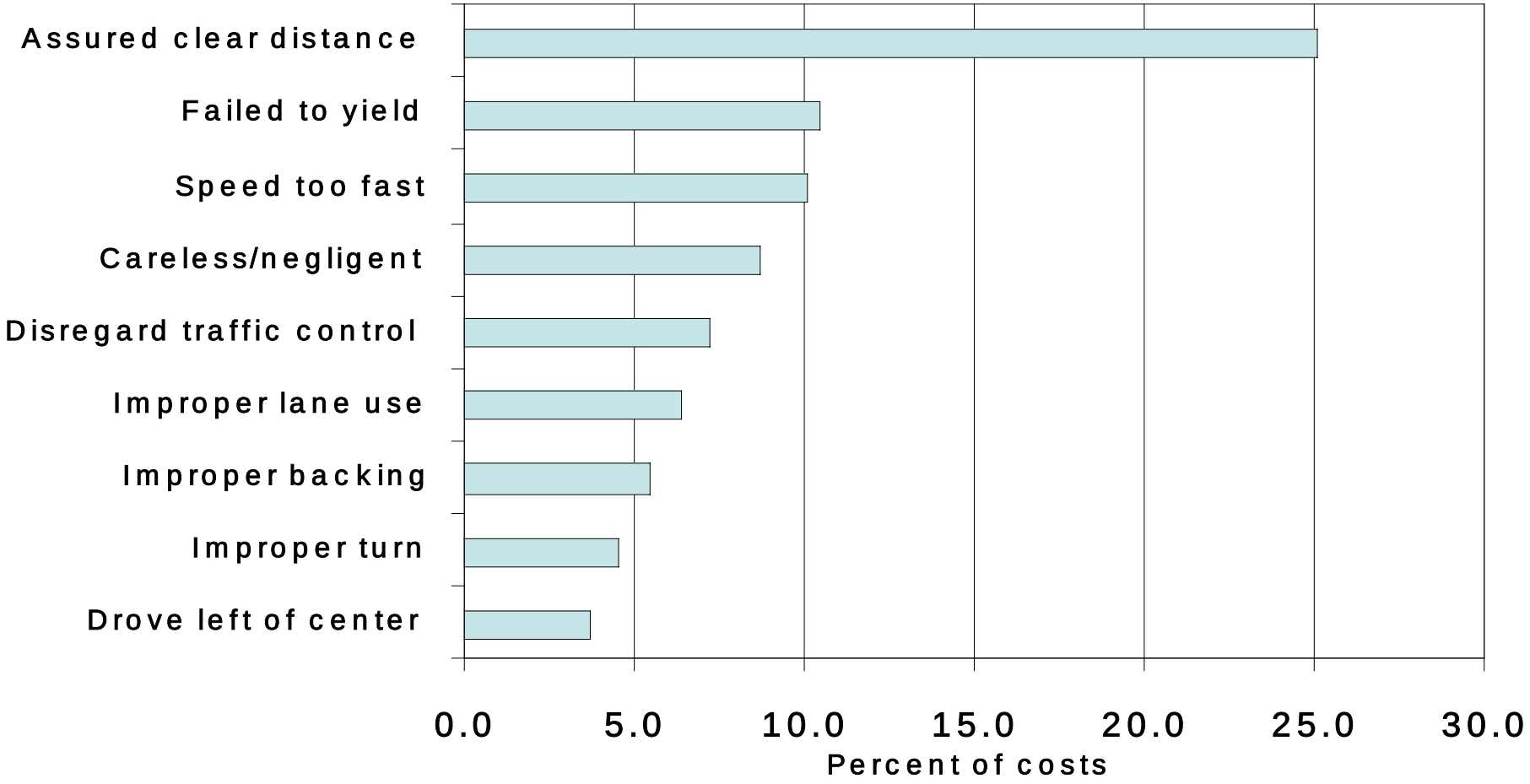
Top CMV Hazardous Actions, Ranked by Total Crash Costs



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Driver Age and Driver Fatigue

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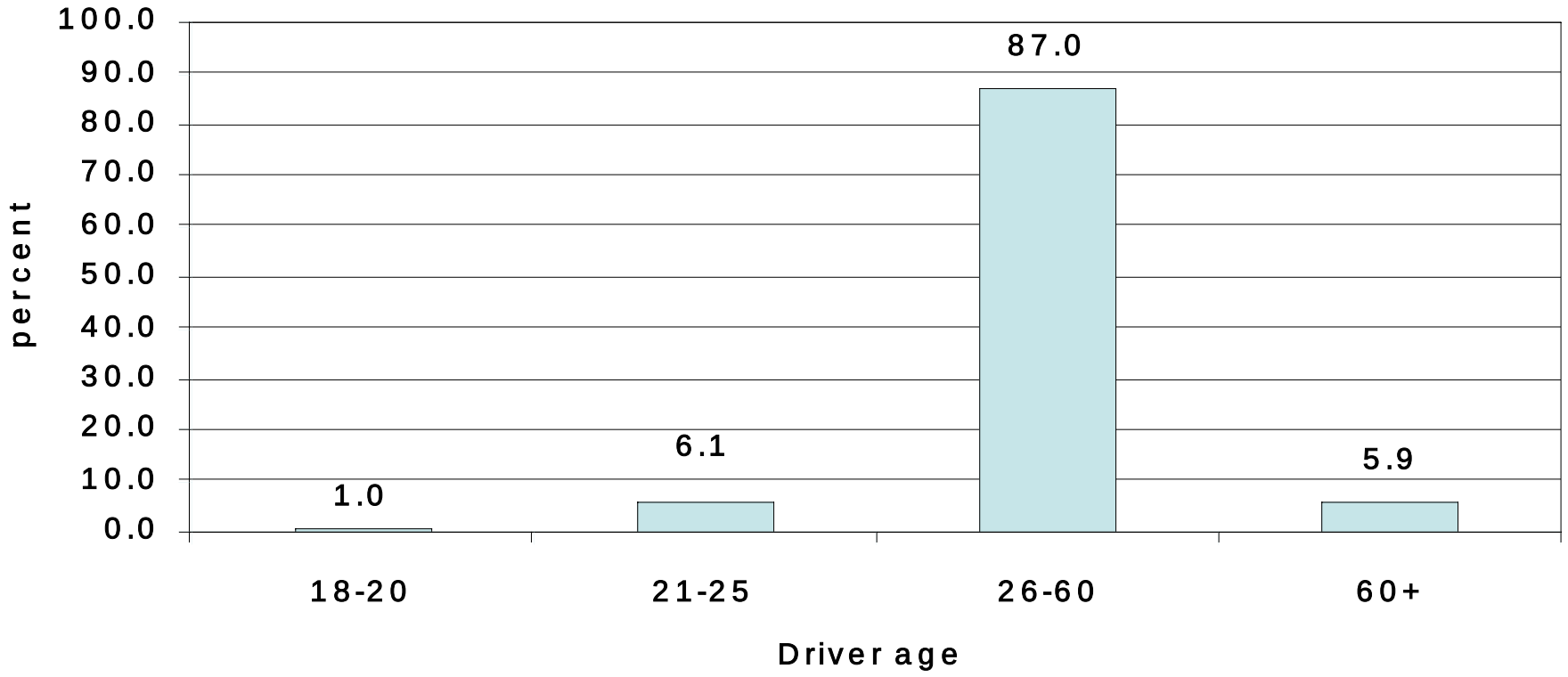
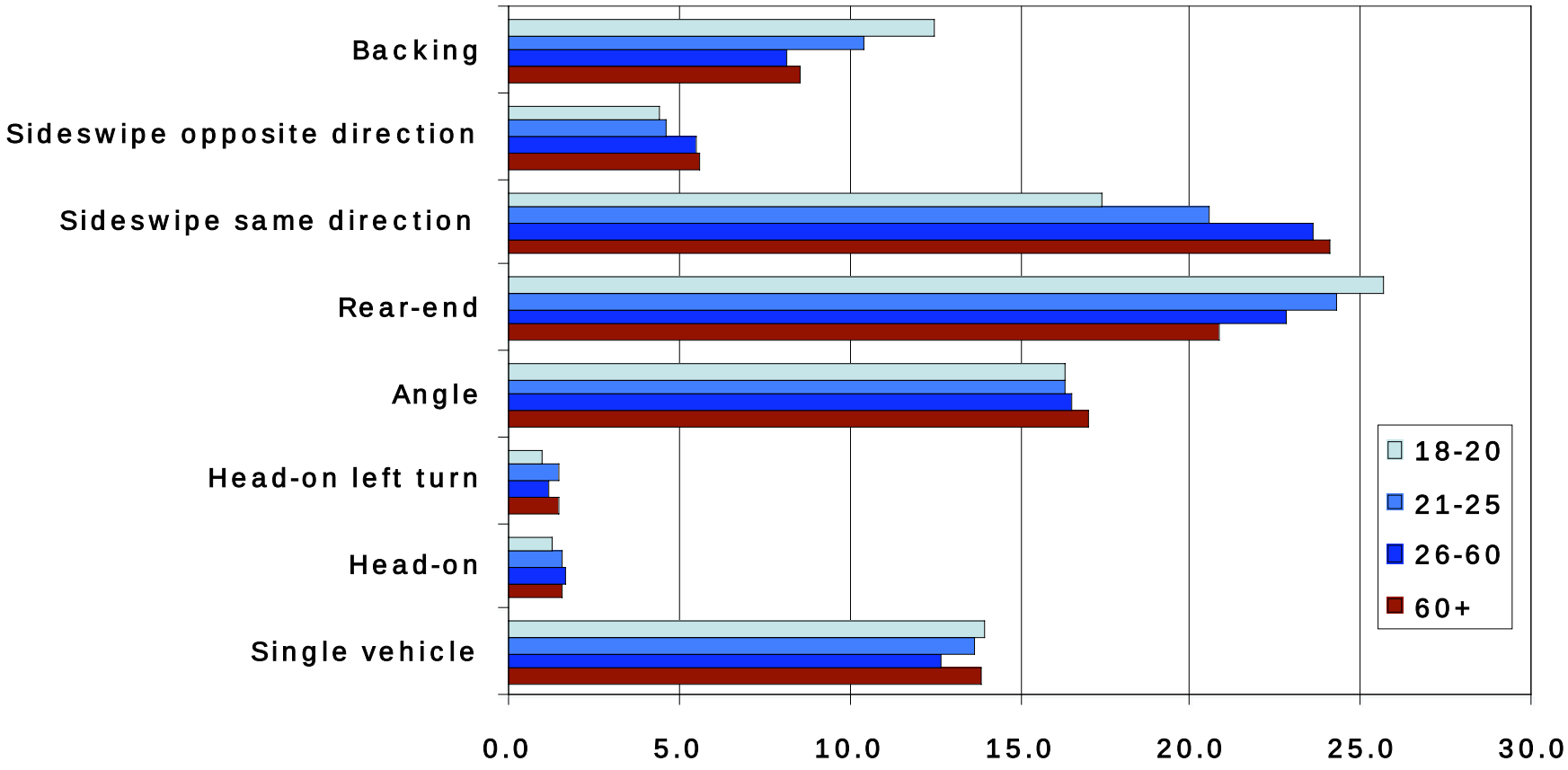
CMV Driver Age (adjusted)



CMV Driver Age by Crash Type



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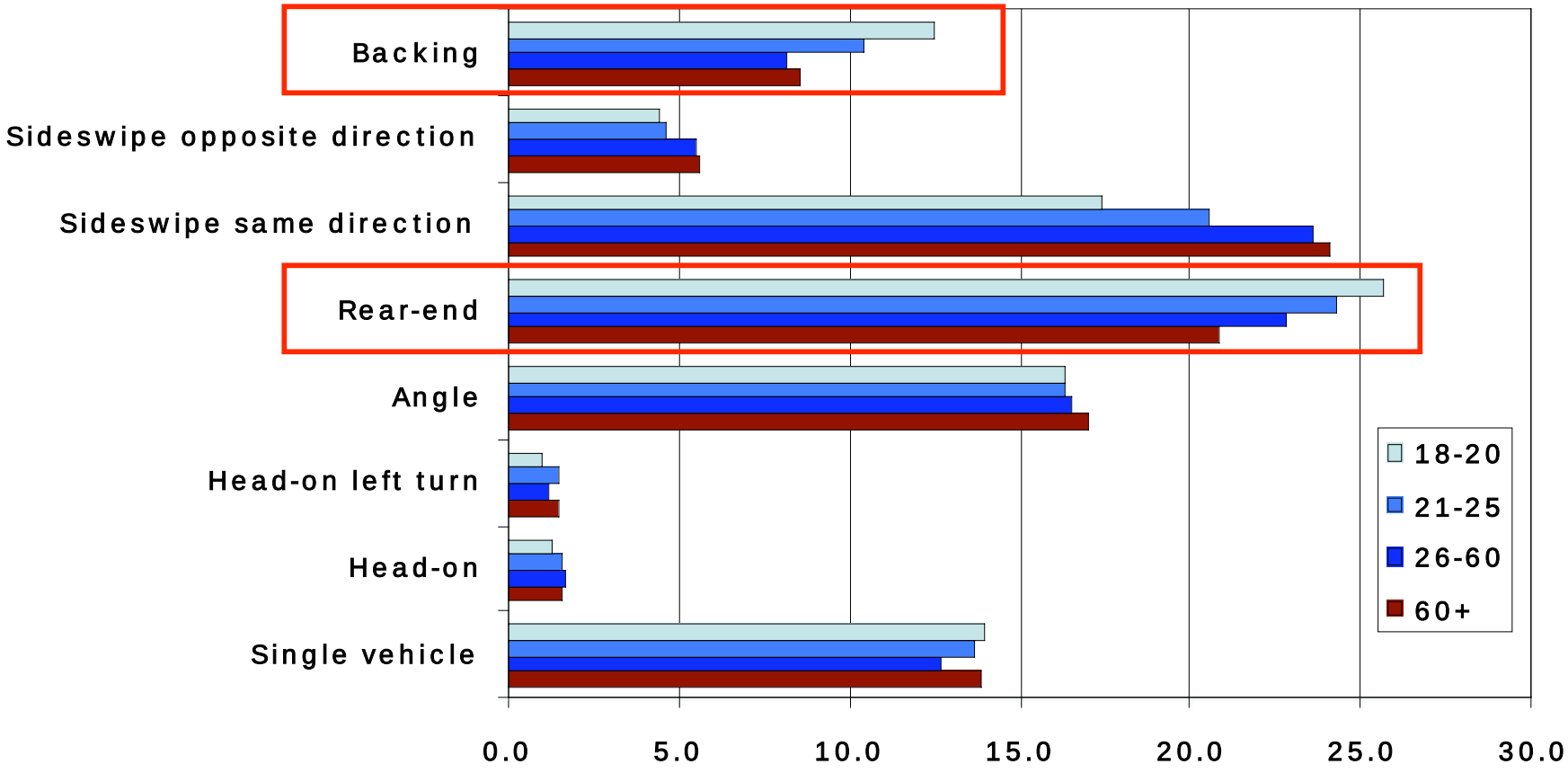
Younger Drivers Overinvolved in Backing & Rear-end Crash Types



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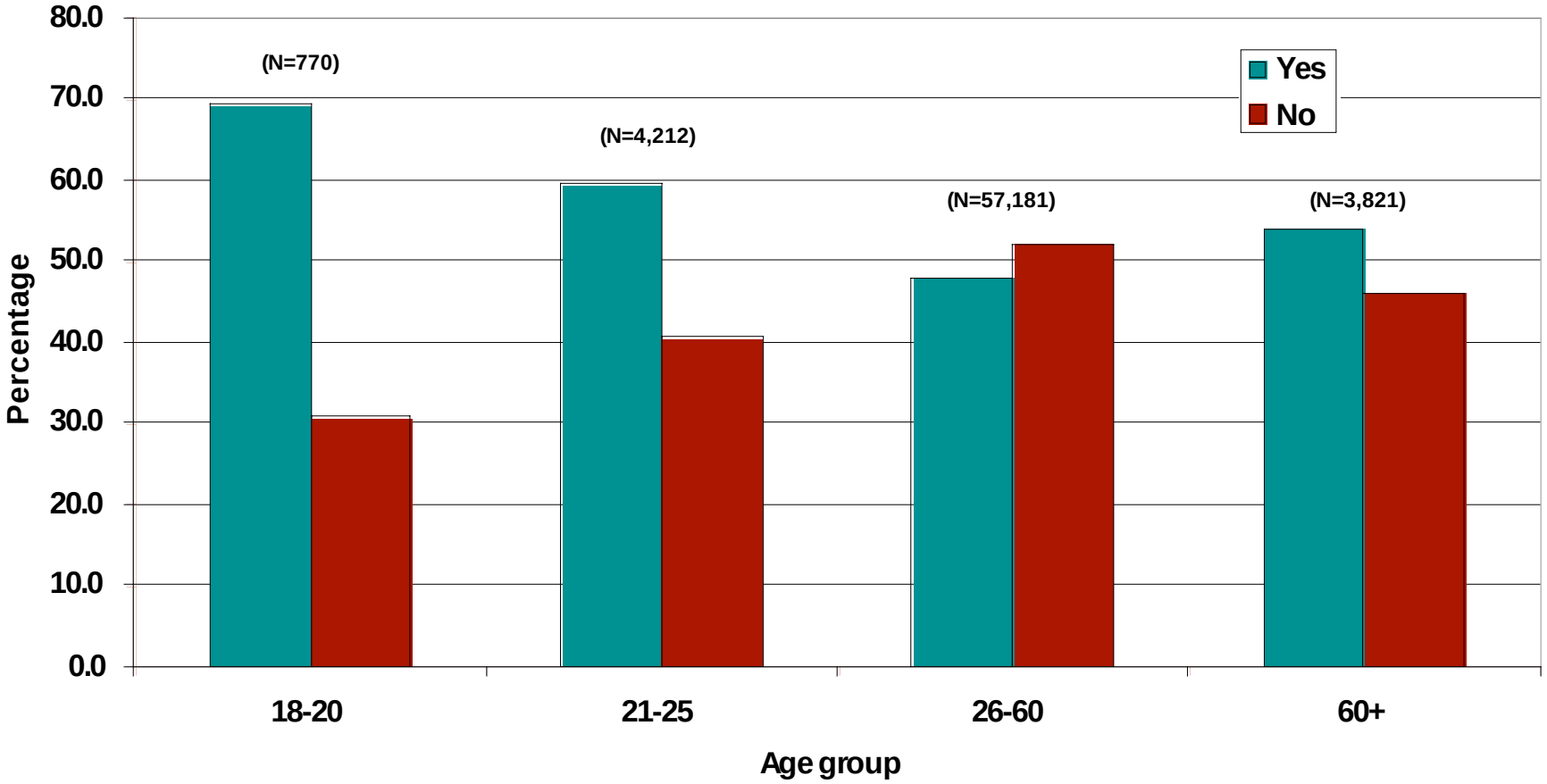
Hazardous Action by CMV Driver Age



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Younger CMV Drivers Hazardous Actions

- **Younger drivers much more likely to be coded with hazardous action.**
- **Twice as likely to be coded with improper backing as other CMV drivers.**
- **50 percent more likely to be coded following too close as other CMV drivers.**
- **27 percent more likely to be coded driving too fast.**

CMV Driver Fatigue

- Fatigue/asleep coded in 0.3 percent of involvements
- 56% are in single-vehicle crashes; 22% rear-ends; 12% sideswipes
- More likely to be serious crashes: twice as likely to be fatal or injury
- Scenario: Night, on high speed road, TS, interstate carrier, run-off road crash

Fatigue-related CMV Crashes

- Very likely more than identified
- Best estimate is to correct by 1.4 to 3.1
- Estimated incidence: 0.4% to 1.0% of CMV involvements
- Estimated fatigue-related costs: 0.9% to 2.0% of CMV crash costs

Driver History Analysis

- Do truck drivers involved in crashes have poorer driver records than truck drivers not involved in crashes?
- Do pass car drivers involved in crashes with trucks have poorer records than other pass car drivers?
- Does CMV driver history predict future crashes? Crash severity?
- ??????

Analysis Plan
Michigan Driver Histories, 2001-2005
Comparison Groups

- **1. Drivers of large trucks involved in crashes (64,000)**
  - **With CMV license**
  - **Without CMV license**
- **2. Other drivers in large truck crash (48,000)**
- **3. All CMV –licensed drivers (188,000)**
  - **With CMV crash**
  - **Without CMV crash**
- **4. Sample of non CMV licensed drivers**
  - **With a non CMV crash**
  - **With no crash**

Analysis Plan

Compare following measures:

- **Crashes**
  - **All crashes**
  - **Alcohol-related**
  - **With citation (at-fault)**
- **Violations (original charge)**
- **Suspensions**

Vehicle Condition, Carrier Type, and Carrier Size

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Vehicle Condition and Crashes

- FACT data from 1996-2001
- CVSA Level 1 inspection
- Detailed crash events
- Used to relate vehicle condition to crash involvement
- MCMIS CMV Inspections, MCMIS Carrier registration file

Trucks with Violations by Type FACT Data

Violation type	N	%
Safety belt	15	3.7
Driver log	50	12.3
Hours of service	9	2.2
Other driver reg.	58	14.3
Cab	59	14.5
Coupling devices	14	3.4
Misc. trailer	10	2.5
Brake	142	34.9
Lights/signals	94	23.1
Tires/wheels	59	14.5
Steering	21	5.2
Suspension	39	9.6
Cargo securement	22	5.4
Other	117	28.7

Trucks with Violations by Type FACT Data

Violation type	N	%
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Driver log	50	12.3
Hours of service	9	2.2
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Other	117	28.7

Out of Service Condition Predicts "Fault" in Truck Crashes FACT data

Truck/driver OOS condition	Right-of-way		Total
	Truck	Other vehicle	
No OOS condition	205	47	252
1 or more OOS item	94	43	137
Total	299	99	389
	proportion out-of-service		
No OOS condition	68.6	52.2	64.8
1 or more OOS item	31.4	47.8	35.2
Total	100.0	100.0	100.0
chi=8.09, p=0.004			

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Brake Violations Increase Risk of Striking in Rear-end Crashes FACT data

Brake inspection results	Rear-end type		Total
	Truck striking	Truck struck	
0 violations	15	26	41
1 or more violation	17	11	28
Total	32	37	69
	proportion with violations		
0 violations	46.9	70.3	59.4
1 or more violation	53.1	29.7	40.6
Total	100.0	100.0	100.0
chi=3.89, p=0.05			

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Lights Violations Increase Risk of Being Struck in Rear-end Crashes FACT data

Inspection results	Rear-end type		Total
	Truck striking	Truck struck	
0 violations	28	23	51
1 or more violations	4	14	18
Total	32	37	69
	Proportion of lighting violations		
0 violations	87.5	62.2	73.9
1 or more violations	12.5	37.8	26.1
Total	100.0	100.0	100.0
chi=5.71, p=0.02			

Michigan Trucks Heavier, More Private/Intrastate Carriers TIFA data

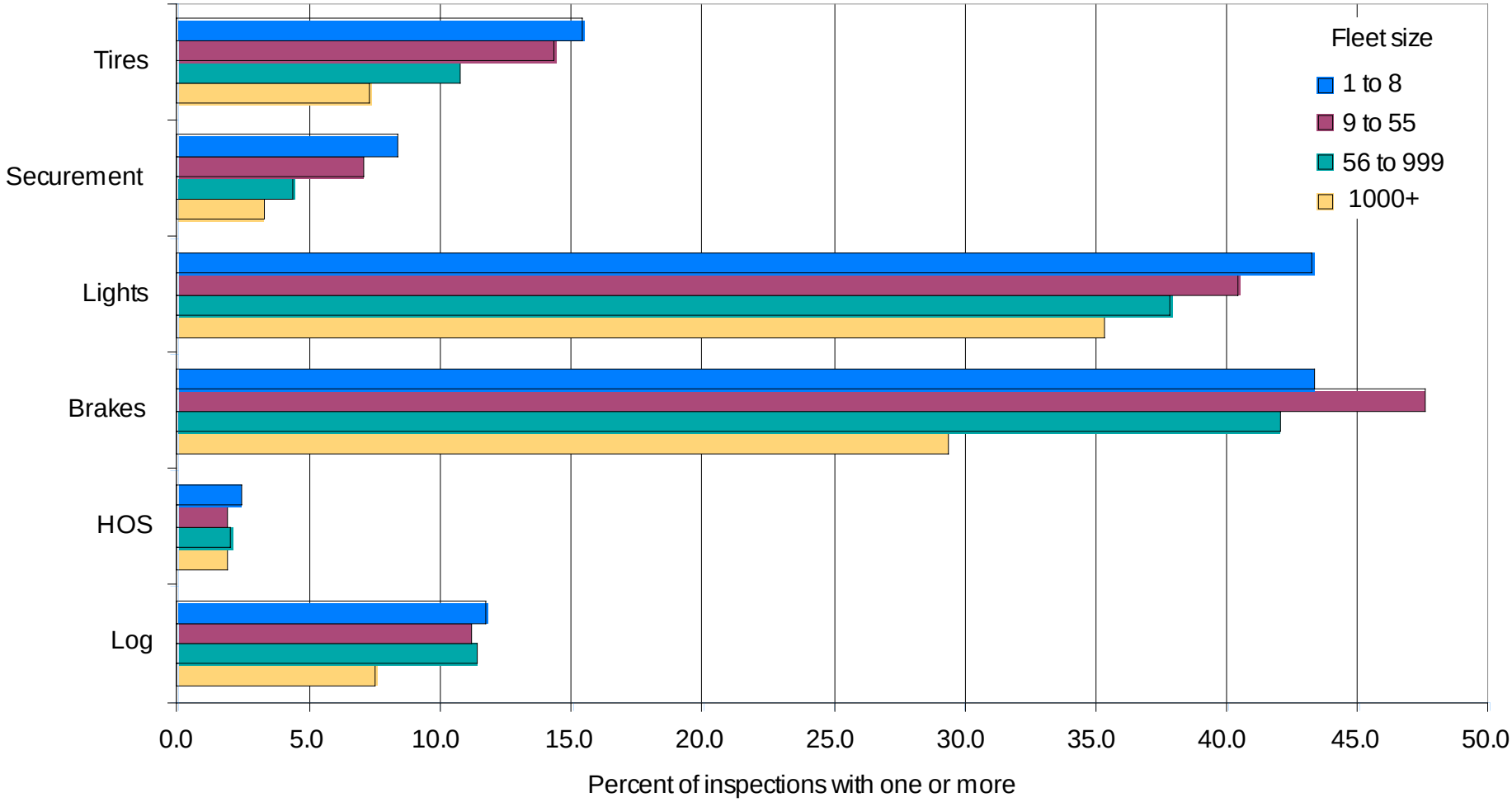
- **Higher proportion of private trucks in fatal crashes, 43.6% to 36.1%**
- **Higher proportion of intrastate carriers: 34.7% to 24.2%**
- **Classic "Michigan" trucks are much heavier than national average:**
  - **Straight, 1 trailer: 60K GCW to 34K GCW**
  - **Tractor, 2 trailers: 90K GCW to 60K GCW**

MCMIS Inspection Data

- 156,000 inspections in Michigan
- 31,000 CVSA Level 1 Inspections
- Obtain fleet size and carrier type information from MCMIS Census file
- 73% for-hire; 17% private; 10% combination

Fleet size	%	Fleet size	%
1-8	25.2	56-999	34.5
9-55	29.4	1000+	10.1

Fleet Size and Violation Rates



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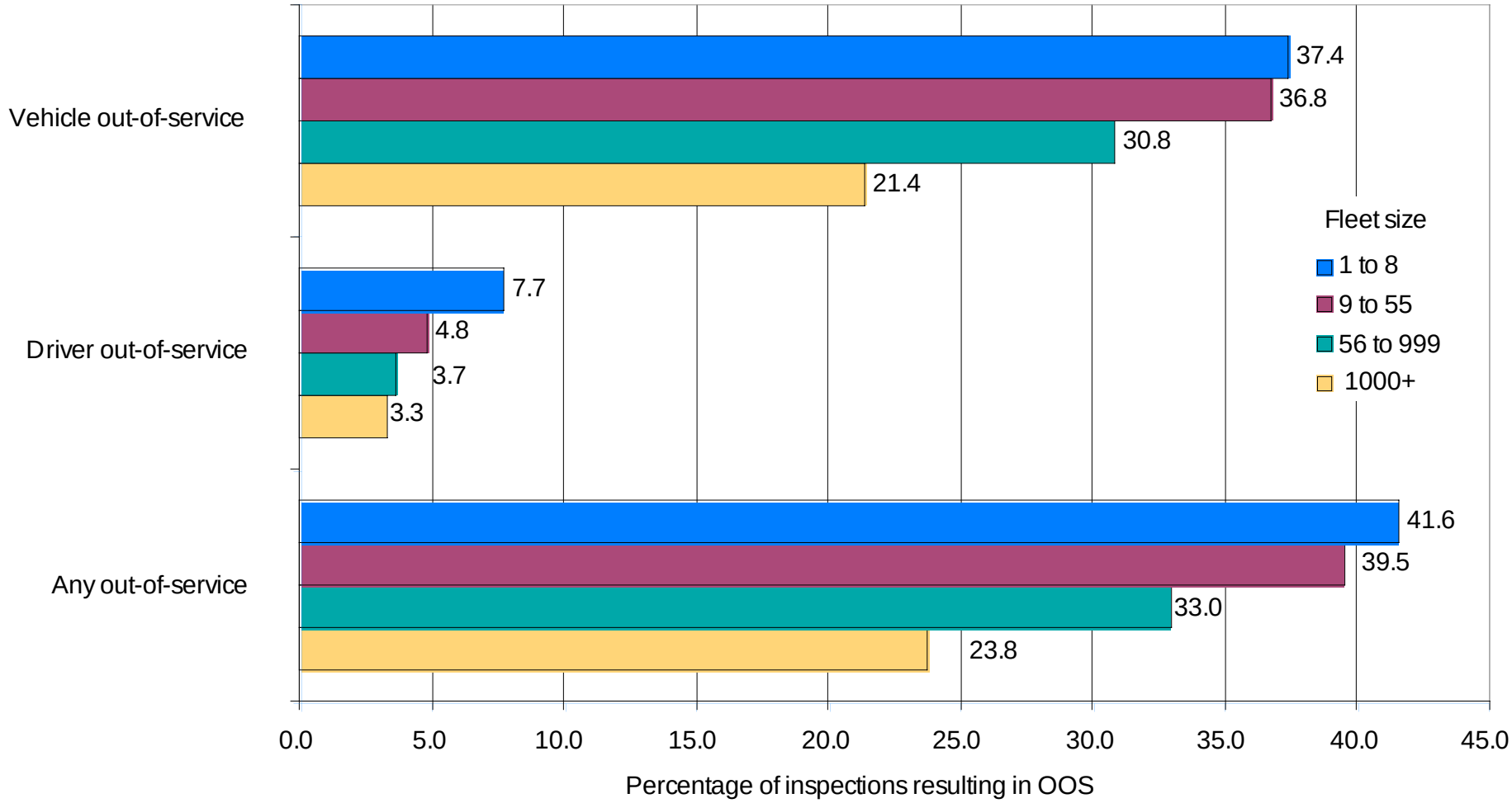
Fleet Size and Out-of-Service



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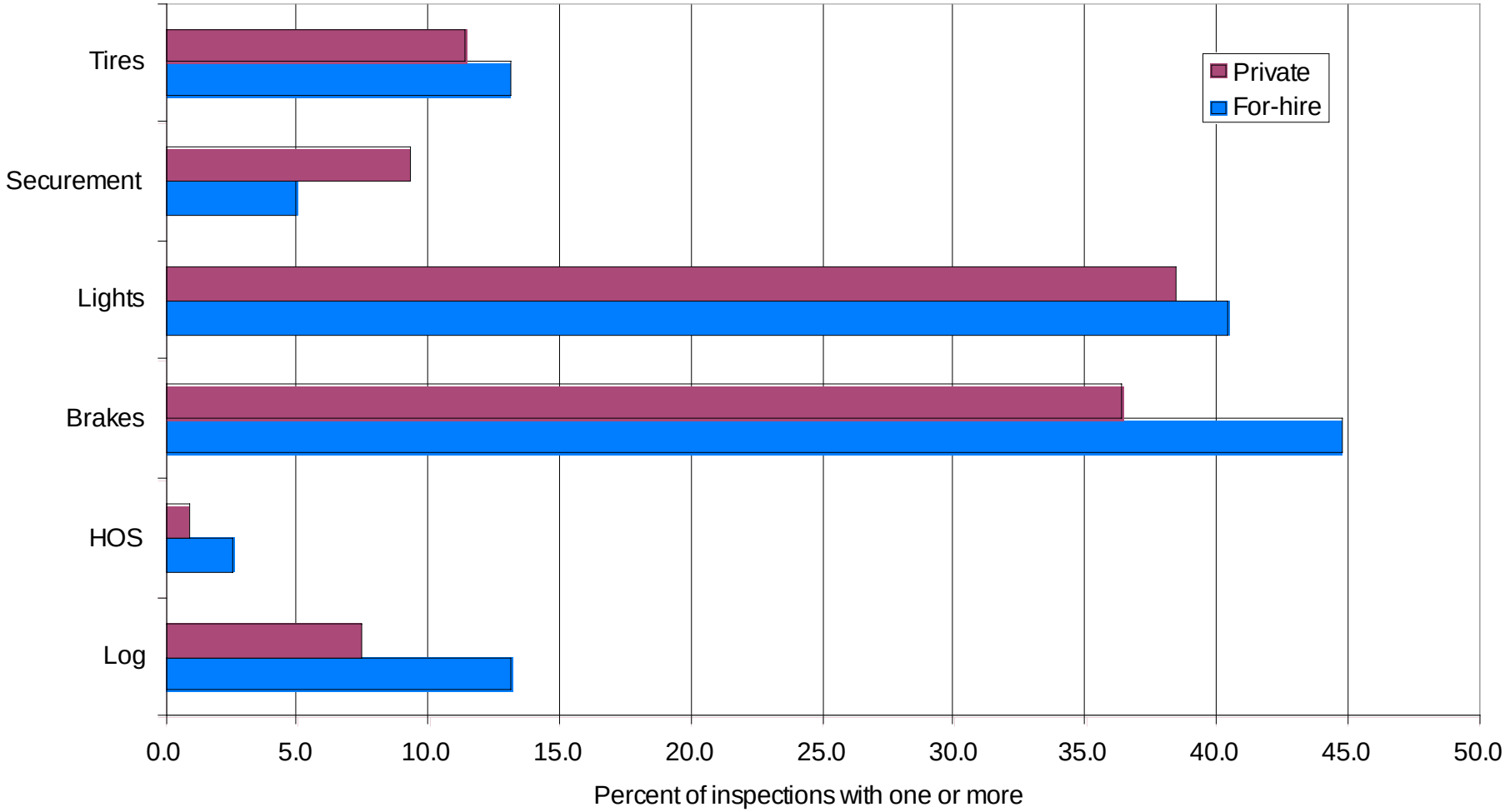
Carrier Type and Violation Types



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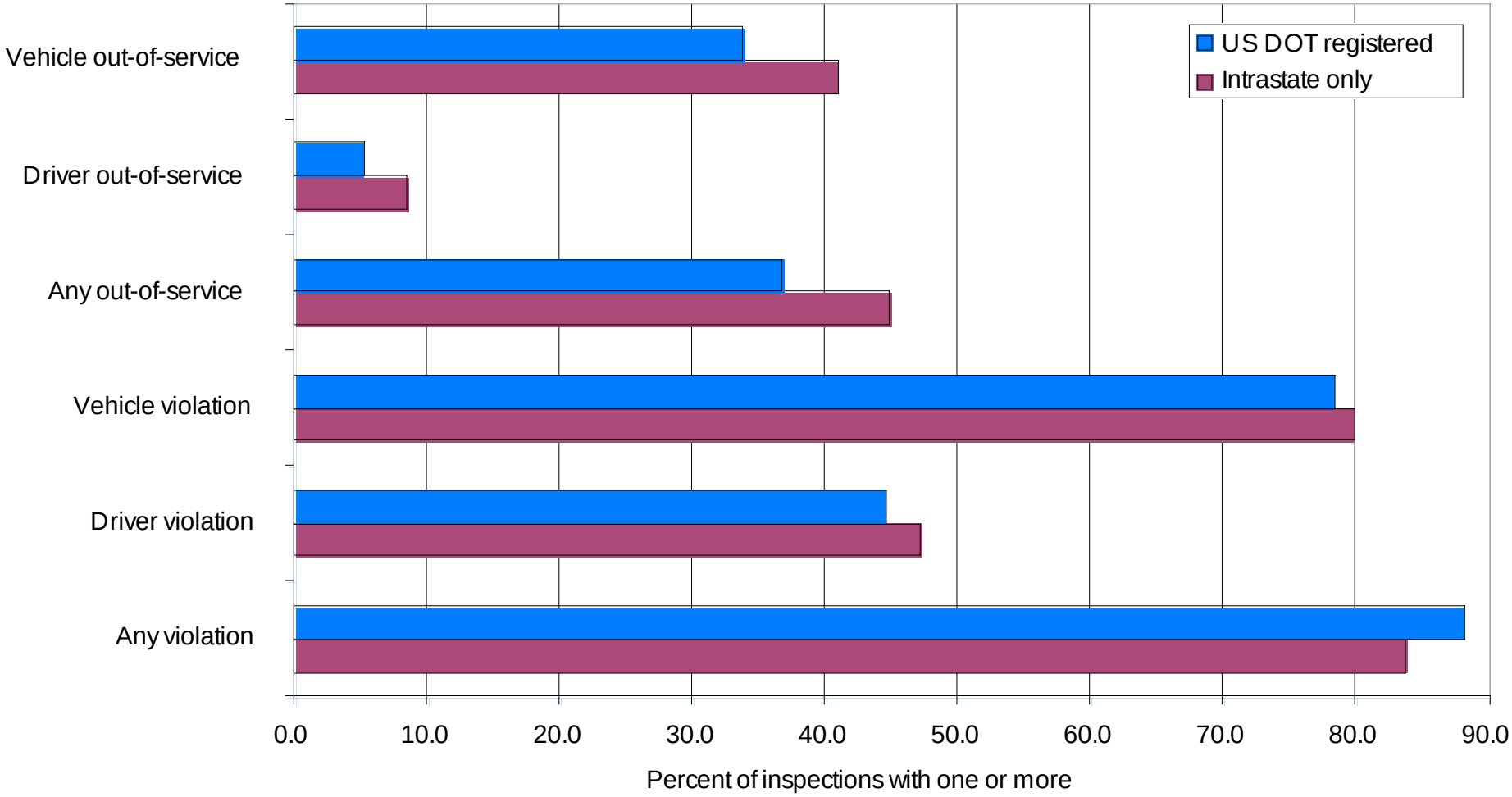
DOT-Registration and Inspection Results



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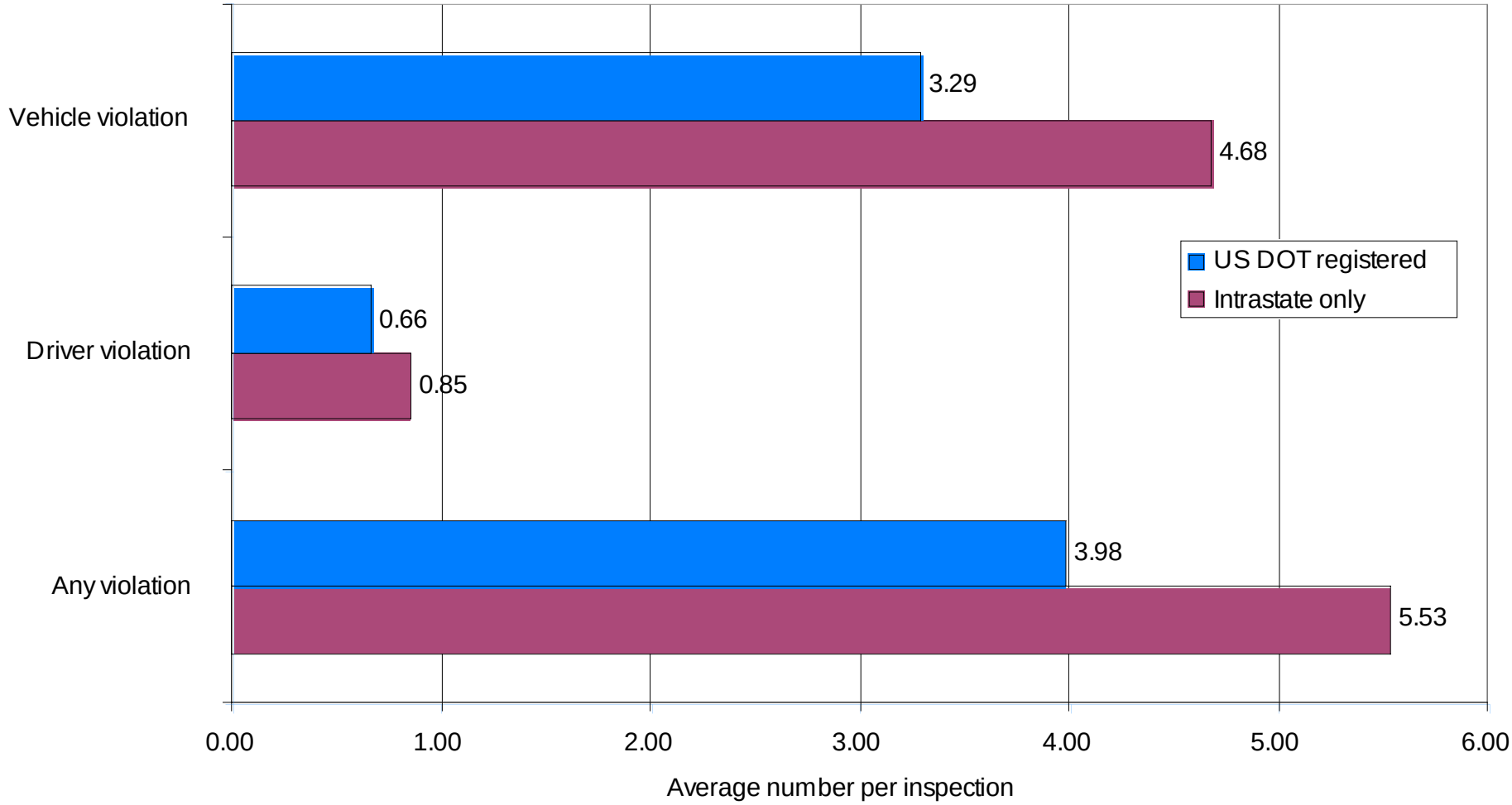
DOT-Registration and Number of Violations



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Geographic Location of Crashes, Costs, and Inspections

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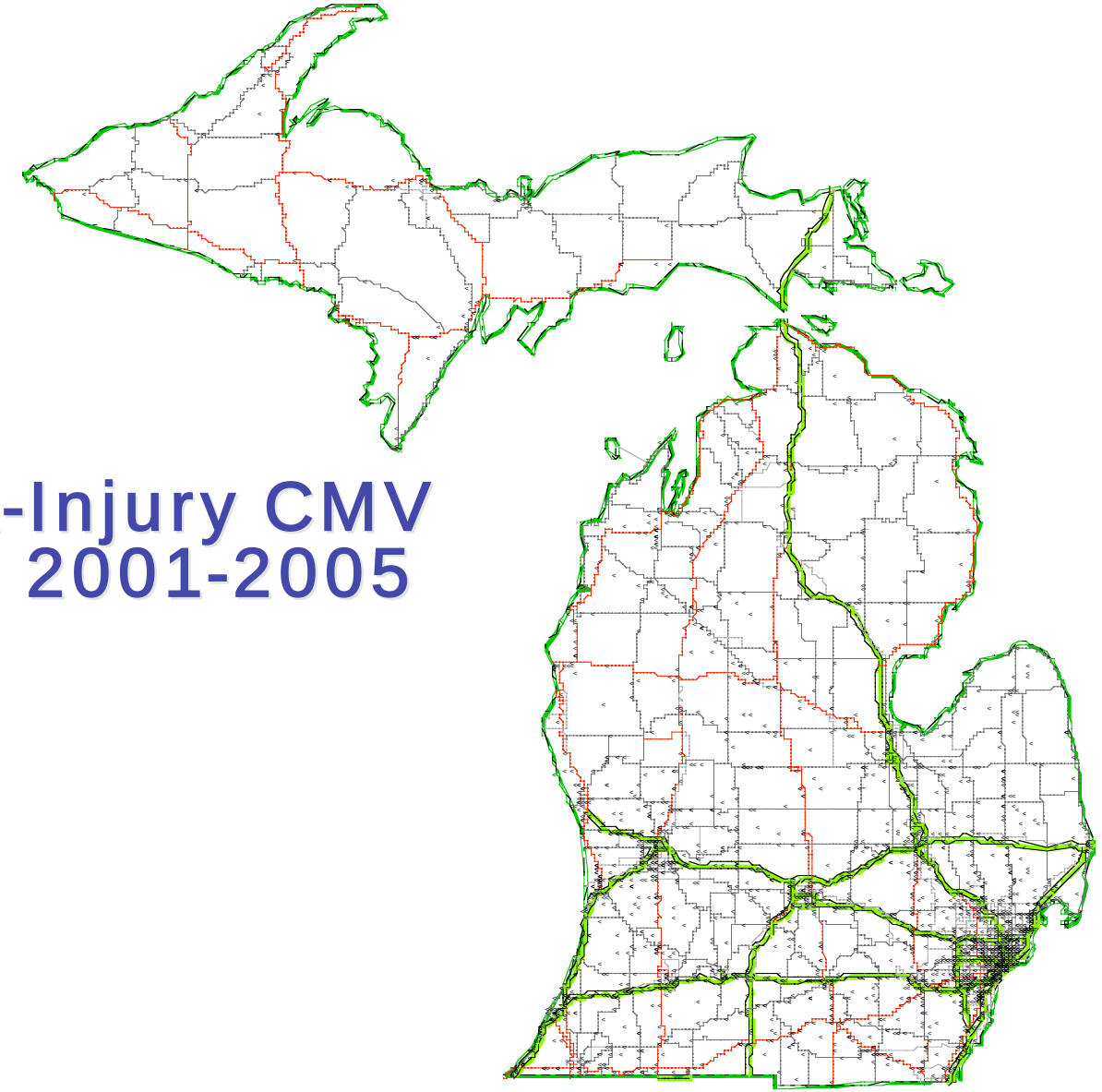
Fatal & A-Injury CMV Crashes, 2001-2005



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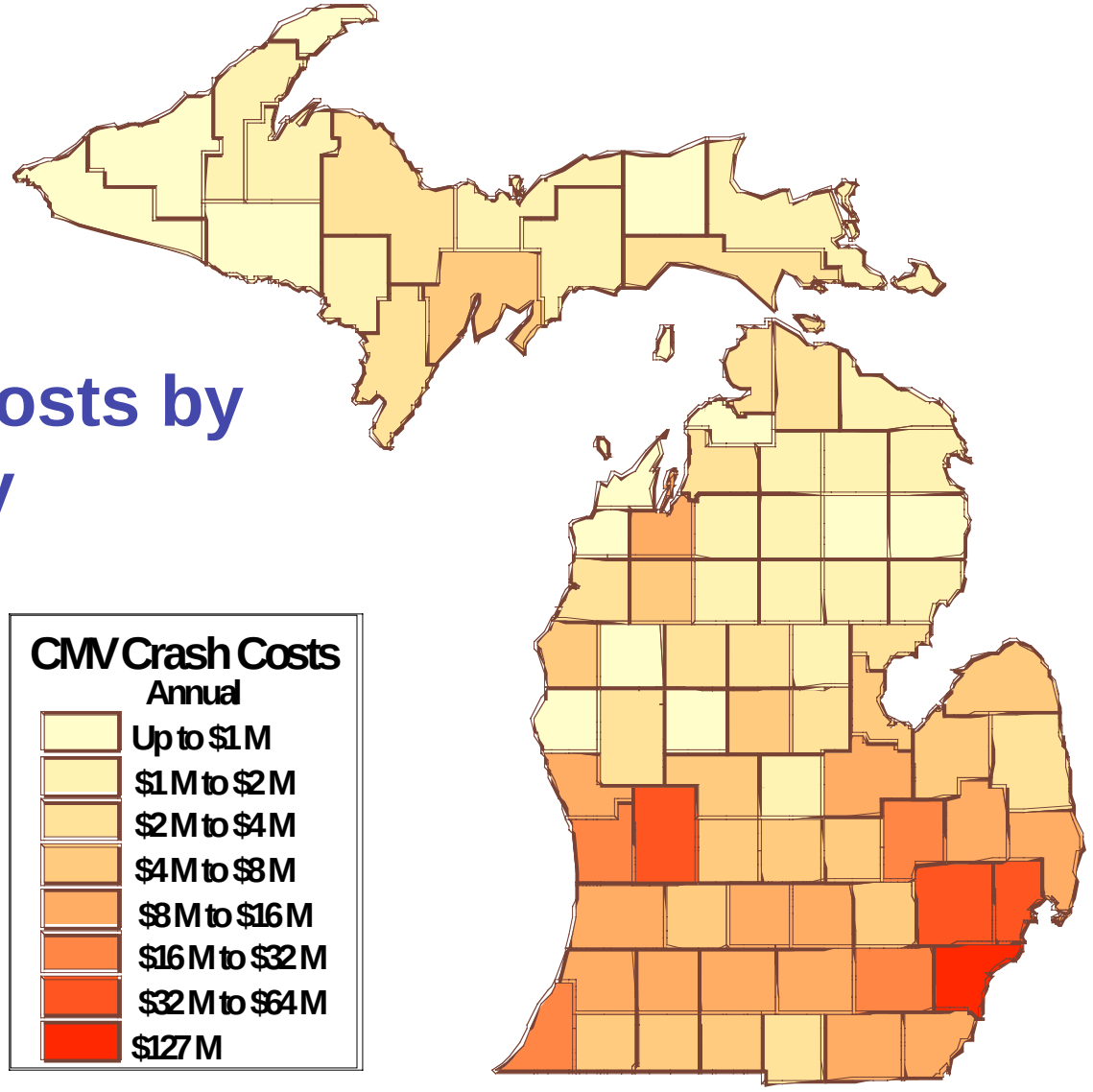
CMV Crash Costs by County



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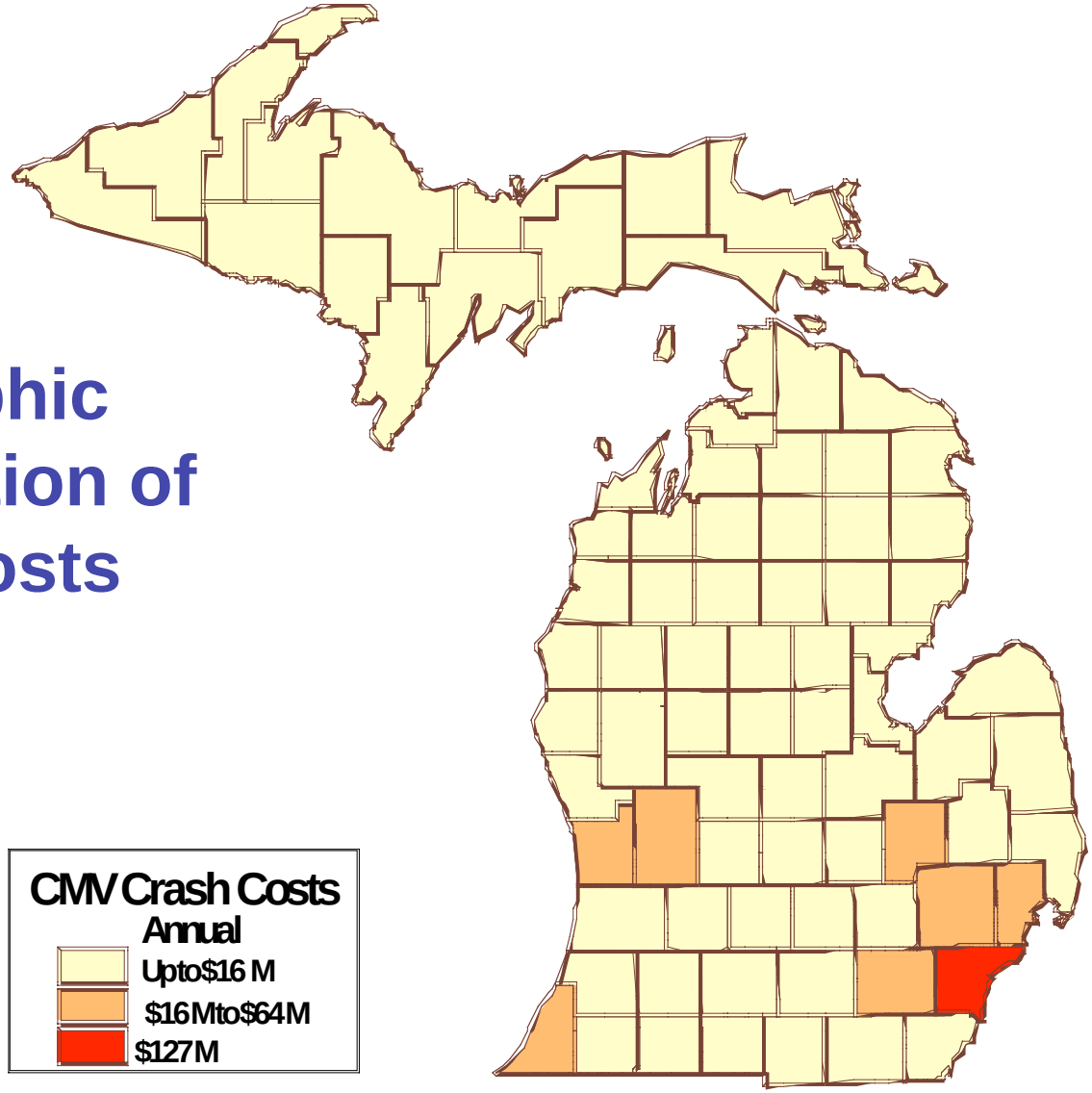
Geographic Concentration of Crash Costs



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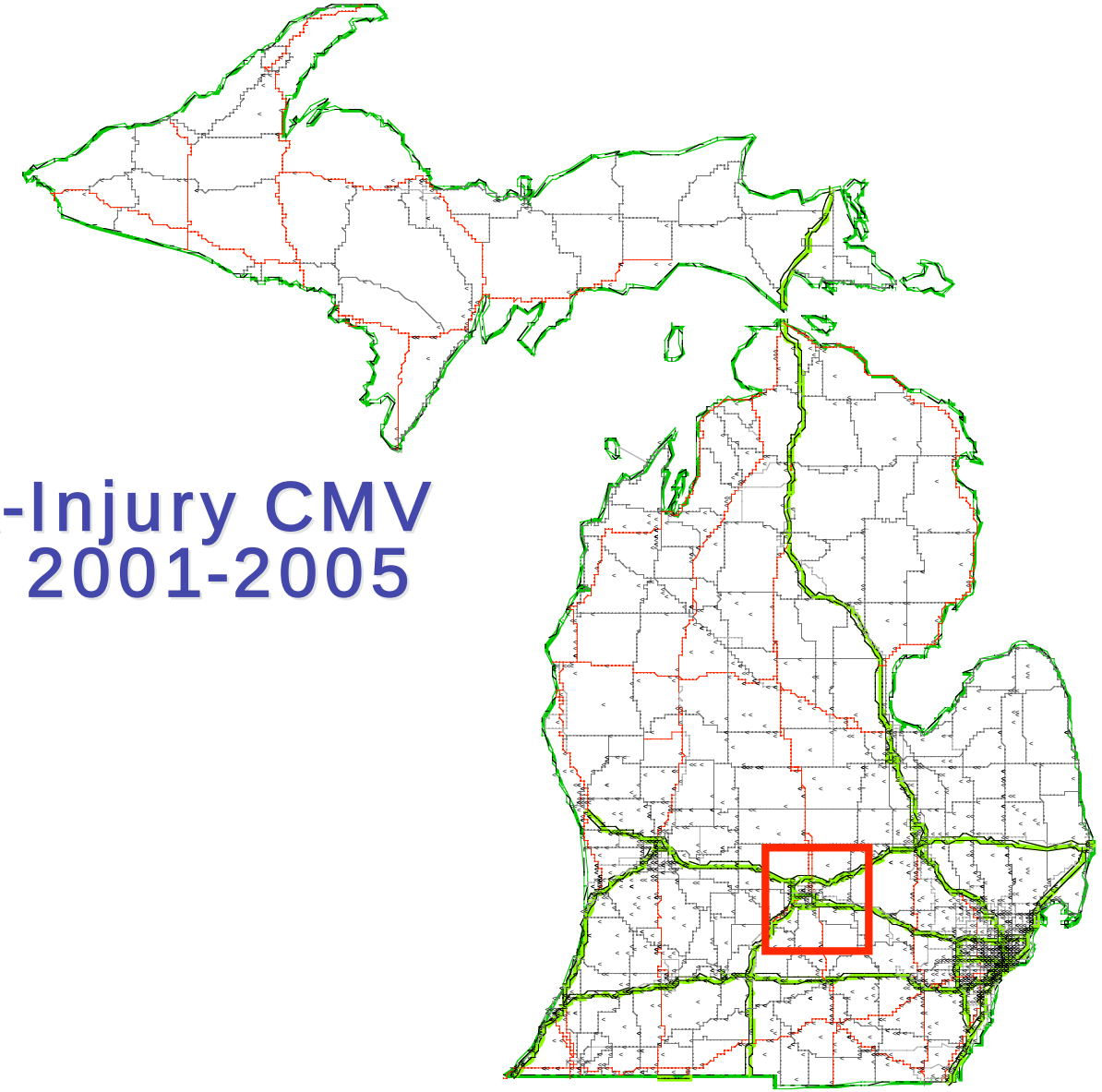
Fatal & A-Injury CMV Crashes, 2001-2005



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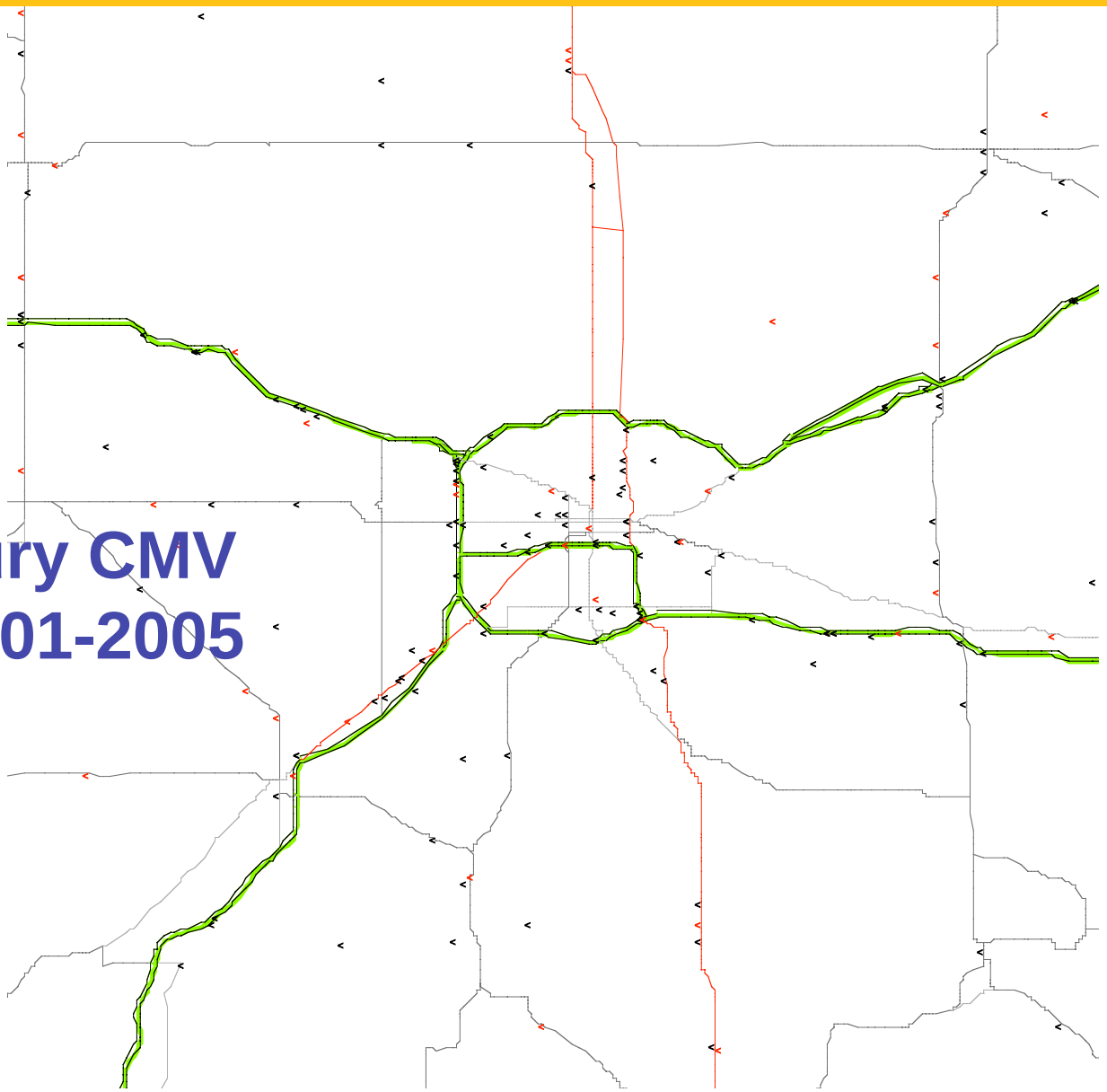
Fatal, A-injury CMV Crashes, 2001-2005



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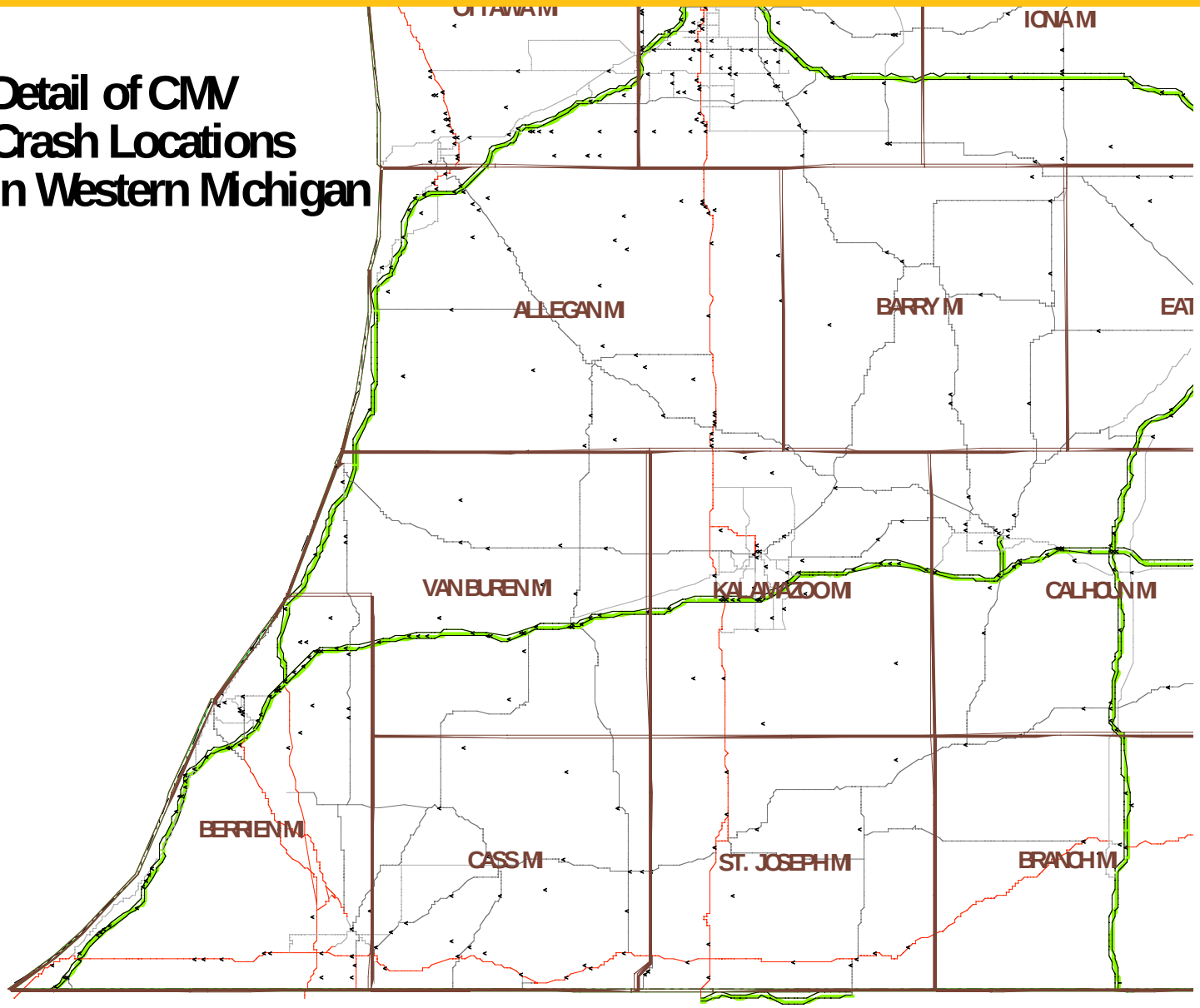
Detail of CMV Crash Locations in Western Michigan



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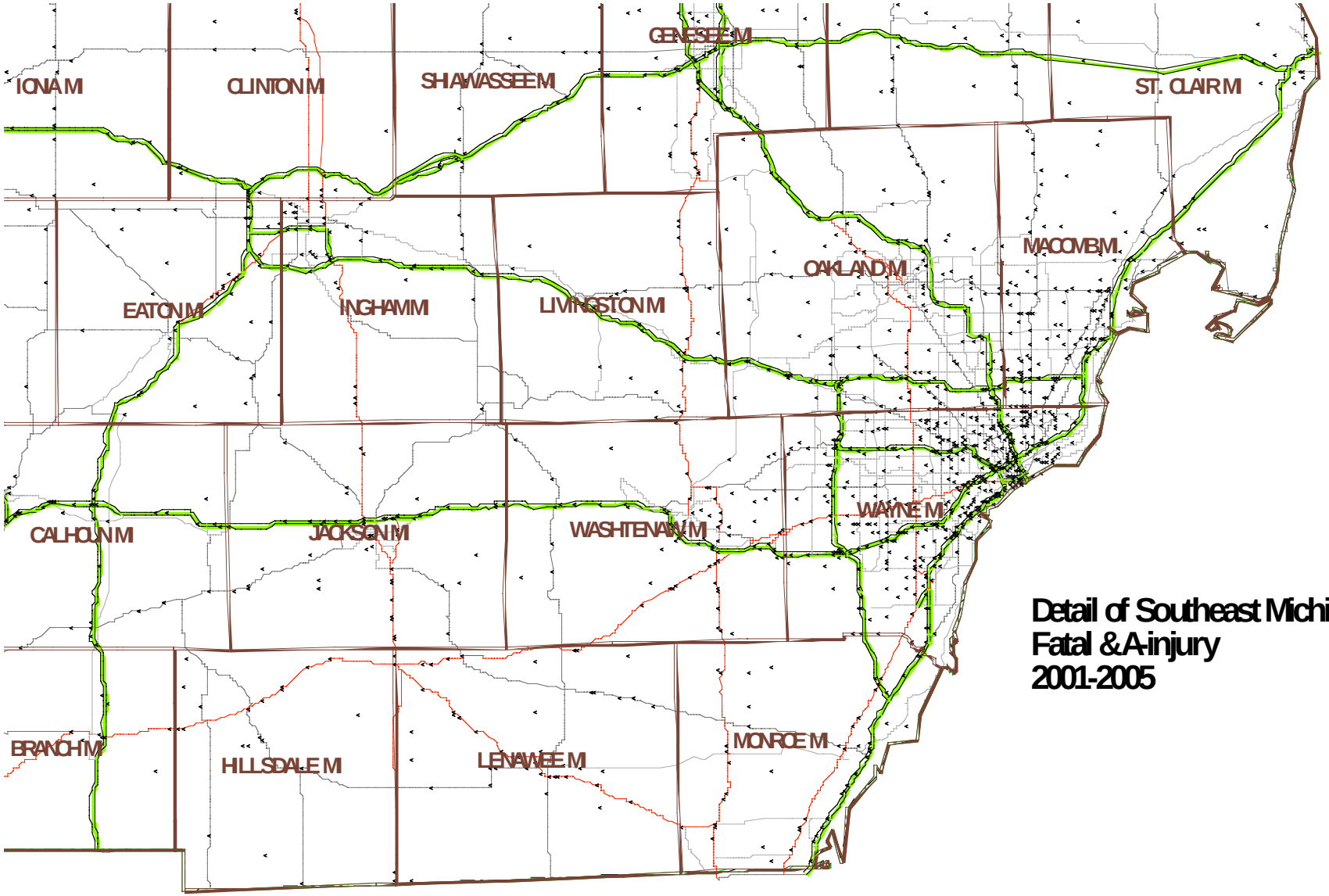

Detail of Southeast Michigan
Fatal & A-injury
2001-2005

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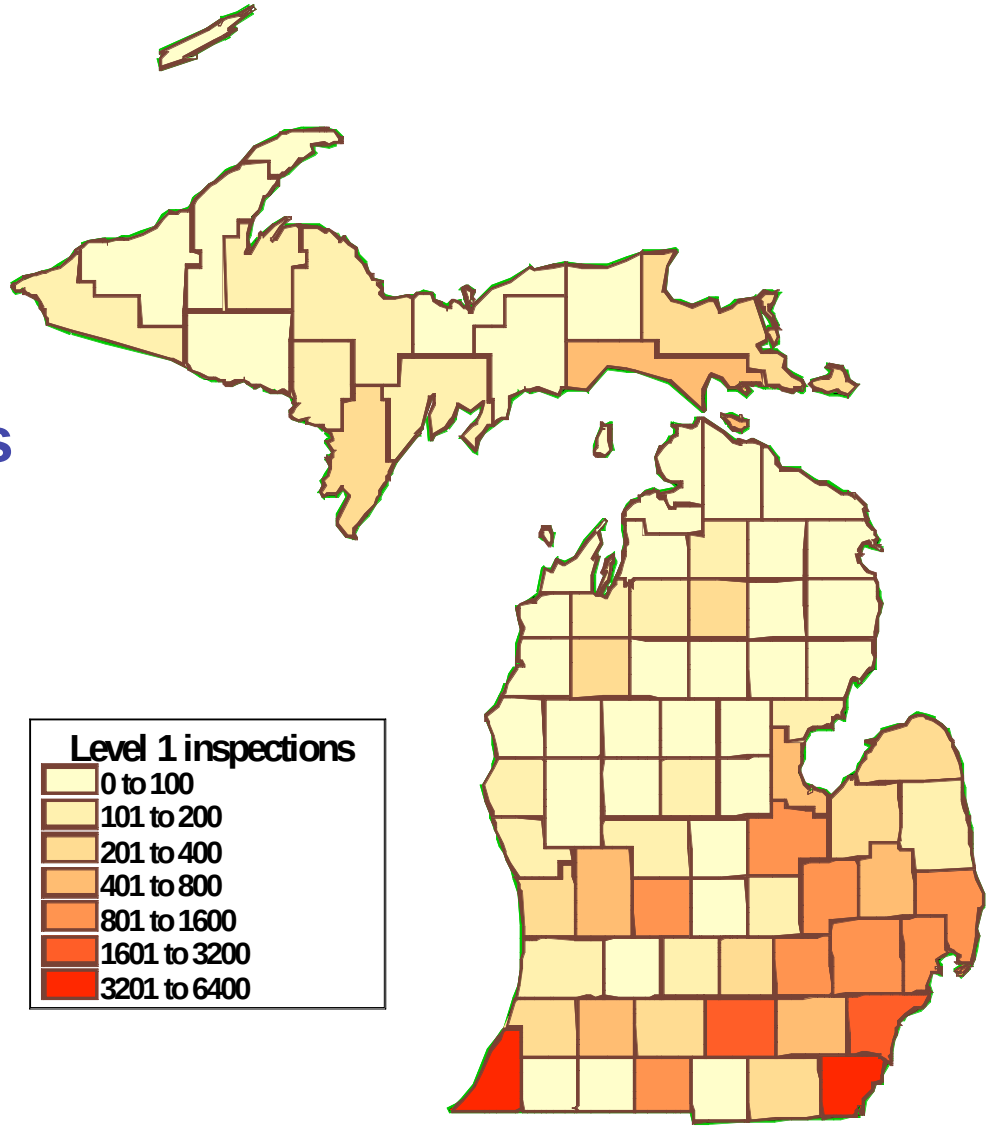
Level 1 Inspections by County



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CMV Crash County and Inspections

County	Rank in crash costs	5-year crash costs	Rank in inspections	5-year Inspections
Wayne	1	$636,626,257	3	2,038
Oakland	2	$275,356,616	5	1,453
Kent	3	$206,701,149	18	408
Macomb	4	$176,034,551	11	1,010
Berrien	5	$119,925,272	2	3,244
Washtenaw	6	$115,848,950	13	719
Genesee	7	$107,450,474	6	1,424
Ottawa	8	$87,567,589	27	240

Summary of Results

- Most costly CMV crashes - fatal
  - Angle, head-on, rear end
- CMV crashes – all severity – by order of overall costs
  - Angle, rear-end, head-on, same-direction sideswipe, single-vehicle
- Brake system defects– rear-end, opposite direction, intersecting path crashes
- Lighting defects – rear-end end crashes (CMV hit)
- Steering defects – opposite direction crashes (CMV encroaching)
- Inspection violation rates highest for CMVs from small fleets
- CMVs from intrastate carriers - higher rates, more serious inspection violations than CMVs from interstate fleets

Summary of Results
hazardous actions

- CMV driver hazardous actions
  - contribute most to overall CMV crash costs:
    - Unable to stop , failed to yeild, speed too fast, careless/negligent, traffic control
  - Most costly individual action
    - Reckless driving, drove left of center, traffic control, careless/negligent, speed, unable to stop
- Younger CMV drivers
  - more likely to be coded with hazardous action
  - More likely to be in back-up crash than older drivers
- In ~1/2 CMV crashes, hazardous action - other driver

Summary of Results
fatigue–related CMV crashes

- **Severe single vehicle crashes**
  - **Driver ran off road**
  - **Rear end crashes**
- **most occurred**
  - **At night (0000-0600 hours)**
  - **On Interstate roads**
  - **Involved tractor-semi trailers or doubles operated by interstate carriers**
- **Account for 2%-3% of total CMV crash cost in Michigan**

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Summary of Results
location

- 8 counties account for ~1/2 of MI annual CMV crash cost
  - Wayne, Oakland, Kent, Macomb, Berrien, Washtenaw, Genesee, Ottawa
- 4 of these are not among top 8 for inspections

Countermeasures and Strategies

Problems are interrelated and complex

Multi-pronged approach is needed

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Vehicle Condition

- **Compliance with FMCSS**
  - **Enforcement**
    - Target areas with highest crash occurrence and costs
  - **Promote and strengthen preventive maintenance programs**
    - Maryland
  - **Proactive approach**
    - New York compliance letter
    - Tennessee Alternative Commercial Enforcement Program

Educational, training, consultation programs

- **Michigan Center for Truck Safety**
  - Help improve safety culture at carriers
  - Consultations on safety compliance
  - Advise on building stronger safety program
  - Workshops for managers, drivers, dispatchers
  - Driver training - continue
    - Younger drivers – backing-up

Increase public understanding of hazards of driving near large trucks

- *Share the Road* PIE campaigns
- Driver education
  - Novice driver course curriculum
  - Driver handbooks
  - CDL license
- Media coverage
  - Newspaper articles – follow safety-belt model

Strengthen CDL program

- Use computer hardware and software for knowledge part of CDL exam
- Review and audit examiners
  - Statistical analysis of test scores and failure rates
  - Covert surveillance
  - Thoroughly evaluate examiners – recertify yearly

Improve Data

- Simple change in UD-10 form to distinguish truck from bus
- Supplemental form – simplify form – separate variables for vehicle configuration, cargo body, hazardous material and GVWR
- Improve recording of unit type and axles
- Improve collection of administrative information – e.g., go to bar codes

Promote and Encourage Truck Safety Technology

- Electronic braking systems
- Conspicuity lighting
- Fender-mounted & convex side mirrors
- Roll-stability advisors and controllers
- Electronic stability control
- On-board recorders
- Vehicle and cargo tracking
- Speed regulation (limiter) systems

Advanced Technology

Participate in pilot studies, encourage with tax incentives

- **Collision-avoidance systems**
  - **Front-radar systems**
  - **Adaptive cruise control**
  - **Side-object detection**
- **Lane Departure warning systems**

Thank you

Questions or Comments?

Go Blue

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